XIX. FISH AND FISHERIES OF MANIPUR WITH SOME OBSERVATIONS ON THOSE OF THE NAGA HILLS.

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(Plates IX—XII.)

CONTENTS.

The collection dealt with in this paper was made by the Zoological Survey Party which visited Manipur in February and March, 1920, and also to a large extent by myself. My best thanks are due to Sardar Dogar Singh, the State Overseer at the time of our visit, who after the departure of Dr. Annandale and other members of the party gave me material assistance in the collection of specimens and in arrangements for touring. He accompanied me to most of the places in the valley and helped me in various other ways. I am also indebted to Mr. A. C. Eleazar for giving me photographic prints from his valuable collection of negatives. Some of these are reproduced here as illustrations. To the Political Agent, Mr. C. W. R. Cosgrave, I am indebted for the services of a man who gave me great assistance in collecting.

My sincere thanks are due to Drs. Annandale and Kemp, to

the former for the great help and valuable suggestions that he gave to me throughout the preparation of this paper, and to the latter for going through the manuscript with me. Dr. Annandale's Monograph[1] on the Fish and Fisheries of the Inlé Lake has served me as a model in writing up the results of my investigations. The illustrations were executed under my supervision by the artists of the Zoological Survey with their usual skill and I must express my indebtedness to them for this work.

INTRODUCTION.

Only a few species of fish have hitherto been recorded from the Manipur Valley and the hills in its immediate vicinity. Day, in his volumes in the *Fauna of British India* records only three from the Naga Hills, *Erethistes hara*, *E. elongata* and *Danio acquipinnatus*. Specimens of other species have, however, been collected in small numbers from time to time in the streams of these mountains. Over half a century ago a small collection was made by Col. H. H. Godwin-Austen, but so far as my knowledge goes no account of it has been published. More recently, in 1910, the Rev. Mr. Pettigrew sent to the Indian Museum a small collection of fish from the hill streams of Northern Manipur. The species in this collection, as Dr. Annandale informs me, were all obtained in the hill country, probably from the neighbourhood of Ukhrul which is situated at an altitude of 6,000 ft. Two new species found by Mr. Pettigrew, *Nemachilus manipurensis* and *Danio naganensis*, were described by Dr. B. L. Chaudhuri,[2] while notes on some of the other species are incorporated here.

The list of the species given below is based on the information obtained from all these sources and from our own collection, which is of course much the largest. Under the name Naga Hills I include all the country inhabited by Naga tribes and not merely the district to which the name is officially applied.

LIST OF FISHES OBTAINED FROM MANIPUR AND THE NAGA HILLS.

Loktak Lake.

Clarias batrachus (Linn.).
Callichrous bimaculatus, Bloch.
Macrones bleekeri, Day.
Labeo calbasu (Ham. Buch.).
Labeo pangusia (Ham. Buch.).
Barbus sarana caudimarginatus, Blyth.
Rohtee belangeri (C. and V.).
Lepidocephalichthys irrorata, sp. n.
Ambassis ranga (Ham. Buch.).
Ophiocephalus harcourt-butleri, Annand.
Barbus conchonius (Ham. Buch.).
Barbus ticto (Ham. Buch.).

[1] Annandale, *Rec. Ind. Mus.*, XIV, pp. 33—64, pls. i—viii (1918).

[2] Chaudhuri, *Rec. Ind. Mus.*, VII, p. 443, pl. xl, figs. 4, 4*a*, 4*b* and pl. xli, figs. 1, 1*a*, 1*b*; p. 441, pl. xl, figs. 1, 1*a*, 1*b* (1912).

Sluggish Streams in the Manipur Valley.

Clarias batrachus (Linn.).
Wallago attu (Schn.).
Callichrous bimaculatus, Bloch.
Macrones bleekeri, Day.
Macrones (*Macronoides*) *affinis* (Blyth).
Glyptothorax[1] *dorsalis*, Vinciguerra.
Glyptothorax minutus, sp. n.
Gagata cenia (Ham. Buch.).
Garra nasutus (McClelland).
Labeo calbasu (Ham. Buch.).
Labeo angra (Ham. Buch.).
Labeo pangusia (Ham. Buch.).
Crossochilus latia (Ham. Buch).
Barbus ticto (Ham. Buch.)
Barbus conchonius (Ham. Buch.).
Barbus sarana caudimarginatus, Blyth.
Rohtee belangeri (C. and V.).
Rohtee alfrediana (C and V.).
Barilius barila (Ham. Buch.).
Danio (*Brachydanio*) *acuticephala*, sp. n.
Botia berdmorei (Blyth).
Botia histrionica, Blyth
Lepidocephalichthys berdmorei (Blyth).
Lepidocephalichthys irrorata, sp. n.
Acanthophthalmus pangia (Ham. Buch).
Nemachilus zonalternans (Blyth).
Ambassis ranga (Ham. Buch.).
Mastacembelus manipurensis, sp. n.
Ophiocephalus harcourt-butleri, Annand.

Streams with Rocky Bed in the Southern Watershed of the Naga Hills.

Garra rupiculus (McClelland).
Garra abhoyai, sp. n.
Crossochilus latia (Ham. Buch.).
Barbus hexastichus, McClelland.
Barbus conchonius (Ham. Buch).
Barbus oatesii, Boulenger.
Barilius barila (Ham. Buch.).
Barilius dogarsinghi, sp. n.
Danio æquipinnatus (McClelland).
Danio naganensis, Chaudhuri.
Danio (*Brachydanio*) *acuticephala*, sp. n.
Lepidocephalichthys berdmorei (Blyth).
Acanthophthalmus pangia (Ham. Buch.).
Nemachilus manipurensis, Chaudhuri.
Nemachilus zonalternans (Blyth).
Nemachilus sikmaiensis, sp. n.
Nemachilus kangjupkhulensis, sp. n.
Nemachilus prashadi, sp. n.

Streams with Rocky Beds in the Northern Watershed of the Naga Hills.

Erethistes hara (Ham. Buch.).
Erethistes elongata, Day.
Psilorhynchus, sp., Hora.
Garra naganensis, sp. n.
Barbus clavatus, McClelland.
Barbus tor (Ham. Buch.).
Barilius barila (Ham. Buch.).
Danio dangila (Ham Buch.).
Danio aequipinnatus (McClelland).
Lepidocephalichthys guntea (Ham. Buch.).

[1] In a paper to be published shortly I give reasons for adopting this name in preference to *Glyptosternum*.

Barbus hexastichus, McClelland.
Rasbora rasbora (Ham. Buch.).
Barilius bendelisis var. *chedra* (Ham. Buch.).
Nemachilus botia (Ham. Buch.).
Badis badis (Ham. Buch.).
Rhynchobdella dhanashorii, sp. n.
Ophiocephalus punctatus, Bloch.

I will now discuss separately the fishes of the four areas enumerated above.

The fish-fauna of the Loktak Lake is, unlike that of the Inlé Lake,[1] not at all specialized. Of the dozen species obtained from it none are endemic, and all these have also been found in the streams of the valley. The only new species from the lake is a small loach of the genus *Lepidocephalichthys* which was equally abundant all over the valley. The major part of our collection was made in the sluggish streams of the flat country. Here four new species were discovered, one of the genus *Lepidocephalichthys* also found in the Loktak Lake, and others belonging to the genera *Mastacembelus*, *Danio* and *Glyptothorax*. Except the *Mastacembelus*, which may grow to a foot or more in length, the new forms are all very small and apt to be overlooked while collecting. Of the remaining species *Barbus phutunio* is said to have been introduced in the Residency ponds from outside the valley. We obtained a large series of specimens but only from these ponds. The eel (*Monopterus albus*) was found buried in mud at the edge of the lake and in rice-fields and was not obtained from any of the streams.

Most of the new species I collected are from the hill streams of the southern watershed which flow into the Manipur Valley from the adjacent Naga Hills. Their restricted distribution is not surprising since they are only found in localised areas in these streams. The new forms chiefly belong to two genera. *Nemachilus* and *Barilius*.

Of the species listed under the heading "Northern watershed, Naga Hills," *Ophiocephalus punctatus*, *Rasbora rasbora*, *Badis badis* and *Rhynchobdella dhanashorii* were netted by me at Dimapur in the plains just north of the Naga Hills. The discovery of a species of *Rhynchobdella* so far inland is interesting. A parallel instance may be given of a marine genus *Moringua*, which has been recorded from the Abor country by Dr. B. L. Chaudhuri.[2] Most of the species obtained in the Naga Hills were collected in the Mithapani and Senapati Streams near Kairong on the main northern watershed of the range. The rest were captured in small streams at various points on the road between the Manipur Valley and Dimapur.

As a result of our investigations 56 species are now known to inhabit the Manipur Valley and the Naga Hills. Of these 27 belong to the family Cyprinidae, 12 to the Cobitidae and 10 to the Siluridae. The remaining seven species are distributed among the families Symbranchidae, Mastacembelidae, Ophiocephalidae,

[1] *Rec. Ind. Mus.*, XIV, pp. 33–64 (1918).
[2] Chaudhuri, *Rec. Ind. Mus.*, VIII, p. 255 (1913).

Nandidae and Percidae. The large number of species and individuals of the first three families, and especially of the family Cyprinidae is a noteworthy feature of the fish-fauna of these regions. Moreover, the members of these families that live in hill streams show certain adaptive characters which are dealt with in detail under a separate heading.

THE PHYSICAL AND OTHER CONDITIONS AS THEY AFFECT THE FISH.

In the general introduction to the fauna of the Manipur Valley, Dr. N. Annandale has given an account of the Loktak Lake. I need here only mention a few of the features that seem to have a special bearing on the fish-fauna.

Dr. Annandale has referred to the luxuriance of vegetation in the lake and has pointed out that it is blocked up to the surface by a thick growth of *Potamogeton*, *Hydrilla* and *Trapa*. From the fact that no specimen of fish, more than a few inches in length, was found in the lake, it is evident that this thick vegetation, while providing food and shelter for the fish, is inimical to the existence of big species, probably because it would retard their progress and make them an easy prey to water-birds, otters, etc. Cover plays a great part in the life of fish and the readiness with which they seek it in the lake is fully illustrated by the devices employed by the Manipuris in capturing them.

Except the snake-headed fish (*Ophiocephalus harcourt-butleri*) and three species of Siluridae, all the fish generally feed on aquatic weeds, on small worms or insect larvae in the mud. Surface-feeding fish (*Nga-wa*) though abundant in the streams of the valley are totally absent from the lake.

The destruction of fish brought about by man's agency is enormous and in fishing Manipuris do not spare the small forms, which only inhabit the lake. After man the most active agents of destruction are certain species of birds. The stomachs of a few cormorants shot near Potsengbaum were found to be full of specimens of *Lepidocephalichthys berdmorei* and *Monopterus albus*. Large numbers of these birds were often observed sitting on floating islands and feeding on the fishes in the lake. The ducks and geese for which this lake is famous among sportsmen do not appear to do much harm, judging from the contents of their stomachs, unless it be by destroying spawn.

On dissection several species of fish were found to be infected with round worms, but the degree of parasitisation was not very high.

The fish of the sluggish streams in the Manipur Valley comprise all those that live in the lake and include some of those the proper habitat of which is the mountain torrents. It is not surprising to find species of *Glyptothorax*, *Garra*, *Nemachilus* and other highly specialized genera in muddy streams when it is realised that within a short distance a mountain torrent may become a

sluggish stream in almost level country. During my tour I was able to make collections from the same stream at different places where the bed was sometimes rocky and sometimes muddy. For example I made a collection in the Thaubal stream near Yaribuk where it is muddy and sluggish and in the same stream about 1 mile from Phadai, where it flows rapidly over a rocky bed. Similarly in Sikmai Stream I made collections at two different places, one near Vabgai in the valley and the other near Palel some six miles from Kakching village, where the stream may be called a torrent. A comparison between the species obtained from the latter stream in the two places is instructive.

Muddy and sluggish, near Vabgai.	Flowing rapidly over a rocky bed, near Palel.
Acanthophthalmus pangia.	*Acanthophthalmus pangia.*
Crossochilus latia.	*Crossochilus latia.*
Macrones bleekeri.	*Garra rupiculus.*
Lepidocephalichthys berdmorei.	*Barilius barila.*
Lepidocephalichthys irrorata.	*Nemachilus zonalternans.*
	Nemachilus sikmaiensis.
	Nemachilus prashadi.

It will be observed that examples of *Garra* and *Nemachilus*, the only genera that exhibit adaptations to life in hill-streams, are found at Palel where the water flows rapidly over a rocky bottom, while those of *Lepidocephalichthys* and *Macrones* that prefer a muddy bottom are only found near Vabgai where the stream is sluggish and muddy. The remaining two species, belonging to *Acanthophthalmus* and *Crossochilus*, are capable of existence under both conditions.

The greatest specialization is found, however, among those fish that actually live in rapid waters. In the species of the genus *Barilius*, the paired fins are greatly expanded and some of their outer rays have become very strong. In older specimens definite muscle-pads are developed on either side of the chest in front of the bases of the pectoral fins. In loaches the mouth is specialized to form a sucker, and by the help of its thick lips the fish are enabled to stick to stones and withstand rapid currents. In *N. sikmaiensis* the mouth is not specialized, but this is compensated for by the higher specialization of the paired fins which are greatly expanded and are provided with muscles on their ventral aspect. The disc of *Garra* and the chest-muscles of *Glyptothorax* are examples of extreme modifications due to adaptation to a particular environment.

GEOGRAPHICAL RELATIONS.

The fish dealt with in this paper belong to two watersheds. The line separating these is a ridge some three miles from Kairong,

between it and Kanglatombi among the Naga Hills. The Imphal River, the chief river of the valley, rises near Kanglatombi and flowing southwards through the valley ultimately joins the Chindwin, a tributary of the Irrawadi. The streams of the northern watershed on the other hand form part of the Brahmaputra System.

Seventeen species of fish belonging to six families and 12 genera are represented from the northern watershed. All the families are widely distributed in the waters of the Oriental and Ethiopian Regions.

Of the 12 genera, 11 are distributed in the freshwaters of the adjacent country, while the genus *Rhynchobdella*, which has hitherto only been found in the deltas of all the large rivers of India and Burma, is now for the first time recorded from far inland.

Of the 17 species, 4 are only known from the Naga Hills. Of the rest, 9 are distributed all over India and Burma and the remaining 4 do not extend to Burma but occur along the base of the Himalayas. *Barbus clavatus*, which is redescribed in this paper, has so far been known from a single specimen obtained from a river at the base of the Sikkim mountains.

On the whole the fauna of the northern watershed, so far as the fish are concerned, is chiefly Assamese and only differs from that of the Brahmaputra Valley in so far as it contains hill-stream species.

Forty-two species of fish collected from the southern watershed belong to six families and 21 genera. All the families are widely distributed in the Oriental and Ethiopean Regions. Of the 21 genera, 20 are widely distributed in India and Burma, while the genus *Monopterus* is confined to south-eastern Asia and has not so far been recorded from the Assam Valley. Of the 42 species, 18 are widely distributed in India and Burma; 11 are known only from Manipur; the remainder with the exception of 3 are exclusively Burmese. Of these 7 were recorded and described from the Sitang River by Blyth,[1] two have been described from the S. Shan States (one by Boulenger[2] and the other by Annandale[3]), and the remaining species by Vinciguerra[4] from Meetan. The only Assamese species are *Garra rupiculus*, which was described from the Mishmi Hills north-east of the Brahmaputra Valley, and *Garra nasutus* of the Khasi and the Mishmi Hills. Annandale,[5] while dealing with the Batrachians of the Abor country, adduced evidence to show that the fauna of the Khasi, Mishmi and other adjacent hill tracts is similar and differs from that found on the other side of the Brahmaputra River. My results confirm the above statement.

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[1] Blyth, *Journ. As. Soc. Bengal*, XXIX, pp. 138—174 (1860).

[2] Boulenger, *Ann. Mag. Nat. Hist.*, (6) XII, p. 201 (1893).

[3] Annandale, *Rec. Ind. Mus.*, XIV, p. 54, text-fig. 2, pl. 2, fig. 7; pl. iv, figs. 16, 17 (1918). [(1889).

[4] Vinciguerra, *Ann. Mus. Stor. Nat. Genova*, XXIX, p. 246, pl. vii, fig. 4

[5] Annandale, *Rec. Ind. Mus.*, VIII, p. 36 (1912).

Barbus phutunio, a widely distributed Indian species, is said to have been introduced into ponds in the Residency gardens at Imphal, in which alone it was found, as an ornamental fish.

Thus we see that the two important elements of the fish-fauna of the S. watershed are the endemic Manipur element and the Burmese element. The endemic element is chiefly confined to the hill-streams and strictly speaking is an isolated one. Some of the species (for example *Botia histrionica*, *Botia berdmorei*, *Macrones affinis*, *Nemachilus zonalternans*, *Lepidocephalichthys berdmorei*), which have so far been known only from a small number of specimens obtained in Burma, are among the commonest species of the Manipur Valley and are represented by large series in our collection.

LOCAL NAMES OF FISH AND THEIR ECONOMIC VALUE, ETC.

Nga is the ordinary word both in Burma and Manipur for fish; but it is never omitted by Manipuris, except in a few cases, when referring to a particular species. Even the large water-bug (*Belostoma indicum*), which Manipuris eat, is called *Nga-Ki-Hum*. Those fish that do not occur in the valley, but are found in the northern watershed, are called comprehensively *Ching-Nga* or "mountain-fish." For most of these species I could obtain no Manipuri name.

Most of the local names were checked in the field by calling them out to a party of fishermen and getting the corresponding fish. The meanings of the names were for the most part given to me by Tumba Singh, whose services were lent to us by the Political Agent. They were also confirmed by other persons, who knew the Manipuri language very well.

There was some difficulty in writing the local names in roman characters, because it was rather difficult to follow their sound, which is partly nasal. However, I was able to get a complete list of the Manipuri fishes in Hindi characters, which I can read myself, and the spellings of the various names may thus be regarded as fairly reliable.

The Manipuris are a very intelligent and observant people and in giving names to the various species have had some regard either for its habit, colouration or resemblance to other animals (*e.g. sarinkhoibi*=otter mouthed). Thus all the species of Barilius are called *Nga-wa*, "air-fish," and all *Nemachilus* with vertical bands *Nga-tup*, "segmented-fish," and any striped fish *Nga-rang*, "striped-fish."

During my visit to Manipur I obtained a considerable amount of information regarding the local names of fish, their value as food and the method by which they are captured and cooked. In the table below I have given the names of all species from the area with which this paper deals, though in a few cases I have not been able to discover the local names or their meanings.

Serial No.	Scientific name.	Local name.	Meaning of the local name.	Economic value of the species and other particulars.
	Family SYMBRANCHIDAE.			
1	*Monopterus albus* (Zuiew).	*Nga puram.*	No explanation was given by the Manipuris. Kaboi Nagas call it *kha-roi*, snake-fish	Manipuris do not eat this fish, because, as they informed me, this name comes after those of all other eatable fish in their holy book, the Puranas. Nagas catch it by a two pronged spear and smoke it without salting.
	Family SILURIDAE.			
2	*Clarias batrachus* (Linn.).	*Nga-kara* ..	"Burnt black fish" The name refers to its black colour.	Fairly good eating. This is captured in large numbers in swamps by cutting the grass and scooping out the water.
3	*Wallago attu* (Schn.)	*Sareng* ..	"Big fish"	Good eating The biggest fish sold in the market.
4	*Callichrous bimaculatus* (Bloch).	*Nga tin.* ..	*tin* "to spit" or "a bow." The dorsal profile in this fish is like a bow; also, according to the Manipuris, the fish spits when taken out of water.	Fairly good eating. During the rainy season, its roe is ground and fried and is used in making a kind of flat cake.
5	*Macrones bleekeri*, Day.	*Nga-chep* ..	*chep* implies the habit of the fish when taken out of water. It shuts and opens its mouth constantly.	Fairly good eating. It is said to have few bones.
6	*Macrones* (*Macronoides*) *affinis* (Blyth).	*Nga-rang* ..	"Striped fish." The name is derived from *arangbah*. This adjective is used for other things also.	Good eating.
7	*Glyptothorax dorsalis* (Vinciguerra)	*Nga-pang.*	*pang* from *pangwa* "innocent." This implies the habit of the fish which does not dart away when disturbed but remains quietly in the same place and is easily caught.	It is said to be full of fat and oil.
8	*Glyptothorax minutus*, sp nov			
9	*Gagata cenia* (Ham. Buch.).	*Nga-rang* ..	[See No. 6 above] ..	The Manipuris do not distinguish this species from *M. affinis*.
10	*Erethistes hara* (Ham. Buch.).	....	....	These species are not represented in our collection. They are known to occur in the Naga Hills.
11	*Erethistes elongata*, Day.			
	Family CYPRINIDAE.			
12	*Psilorhynchus* sp., Hora.	....	....	....
13	*Garra nasutus*, McClelland.	*Nga-mu-sangum.*	*mu* "black"; *sangum* "an umbrella" or "a mushroom" in reference to the mental disc. According to others *sangum* is an insect	Fairly good eating, said to be rich in oil.

Serial No.	Scientific name.	Local name.	Meaning of the local name.	Economic value of the species and other particulars.
			which lives in grass and by its bite produces a swelling.	
14	*Garra naganensis*, sp. nov.	....	....	....
15	*Garra abhoyai*, sp. nov.	....	....	....
16	*Garra rupiculus*, McClelland.	*Nug-nga* ..	"Stone fish" ..	Nagas eat it.
17	*Labeo calbasu* (Ham. Buch.).	*Paing-ba* or *Pemba*.	A fish with a red streak below the cheek and with red iris. *Pemba* denotes red.	Good eating but bony.
18	*Labeo angra* (Ham Buch.).	*Kha-bag*.	*kha*-mouth; *bag* denotes the fleshy appendages which surround the mouth.	Good eating. They are chiefly used for extraction of oil in which other fish and vegetables are fried.
19	*Labeo pangusia* (Ham Buch.).	do.		
20	*Crossochilus latia* (Ham Buch.).	*Nga-rohi* or *nga rohi mapi*.	*rohi* "round," in reference to the cylindrical form of the fish. The young are called *nga-rohi* and the adults *nga-rohimapi* the mother of *nga-rohi*.	The young are bitter in taste while the adults are slightly bitter but not bony.
21	*Barbus sarana caudimarginatus*, Blyth.	*Nga-noi* ..	*noi* "fat;" the young of this fish are called *nga-hau* at Wangjing village.	Full of bones; though its flesh is said to have good flavour.
22	*Barbus oatesii*, Boulenger.	....	....	....
23	*Barbus clavatus*, McClelland.	*Samehet* ..	"Comb fish," in reference to the denticulations along the dorsal spine.	The fish was obtained at Kairong and only the Naga name is given here.
24	*Barbus tor* (Ham. Buch.)	....	....	....
25	*Barbus hexastichus*, McClelland.	*Huru* ..	"Restless fish," makes *hur-hur* agitation or trembling in the water.	Few people eat it fresh. It is generally dried in big trays and then ground into powder, which is used as a condiment like pepper with vegetables.
26	*Barbus ticto* (Ham. Buch.)	*Nga-kha* ..	*khaiba* "bitter." The Manipuris compared the taste of these fishes to that of a tobacco leaf.	
27	*Barbus conchonius* (Ham Buch.).	do. ..	....	....
28	*Barbus phutunio* (Ham. Buch.)	do. ..	....	....
29	*Rasbora rasbora* (Ham. Buch.).	....	....	....
30	*Rohtee belangeri* (C. and V.).	*Tharak* ..	"Flat and thin" ..	[See No. 17 above].
31	*Rohtee alfrediana* (C. and V.).	*Nga-shiksha*	"Compressed fish" ..	Fairly good eating.
32	*Barilius bendelisis* var. *chedra* (Ham. Buch.).			
33	*Barilius barila* (Ham. Buch.).	*Nga-wa*.	*wa* "air;" in reference to the surface feeding habits of the fish. At Kairong some Manipuris called it *nga-ra* on account of the blue bands on the sides of the body.	The intestine, which is also eaten, is said to be bitter. The fish is, however, good eating.
34	*Barilius dogarsinghi*, sp. nov.	do.		

Serial No.	Scientific name.	Local name.	Meaning of the local name.	Economic value of the species and other particulars.
35	*Danio dangila* (Ham Buch.).	....	....	....
36	*Danio aequipinnatus* (McClelland).	....	....	....
37	*Danio* (*Brachydanio*) *acuticephala*, sp. nov.	....	....	....
38	*Danio naganensis*, Chaudhuri.	....	....	....
	Family COBITIDAE.			
39	*Botia berdmorei* (Blyth).	*Sarin Khoibi*	"Otter-mouthed fish."	Very good eating.
40	*Botia histrionica*, Blyth	*Nga-rang.*	"Striped fish" in reference to its black and white colour.	do.
41	*Lepidocephalichthys guntio* (Ham. Buch.)	....	....	....
42	*Lepidocephalichthys berdmorei* (Blyth)	*Nga kshrou* or *Nga-ki-jarau*	*kshrou* "loose mud." The fish lives in loose mud hence the name. The second name signifies its slimy skin like that of a leech *jarau*.	It is generally smoked, but people occasionally eat it fresh.
43	*Lepidocephalichthys irrorata*, sp. nov.	*Nga-nap* ..	*nap* denotes the action of pressing a thing between the fingers hence "a compressed fish"	Manipuris do not like it fresh and generally smoke it.
44	*Acanthophthalmus pangia* (Ham. Buch.).	*Nga-sang* ..	*sang* "thin and long" ..	[See Nos. 25—28 above.]
45	*Nemachilus botia* (Ham. Buch).	....	....	....
46	*Nemachilus zonalternans* (Blyth).	*Nga-rem* ..	....	....
47	*Nemachilus manipurensis*, Chaudhuri.	*Nga-sarva*	....	....
48	*Nemachilus kangjupkhulensis*, sp. nov.	*Laingoi-phumba* or *Sarin*	*phumba* "sand," the fish lives in sand and hence the name.	....
49	*Nemachilus sikmaiensis*, sp. nov.	*Nga-tup* ..	*tup* "segmented," in reference to the vertical band on the sides.	[See No. 42 above.]
50	*Nemachilus prashadi*, sp. nov.	do.		
	Family PERCIDAE.			
51	*Ambassis ranga* (Ham. Buch).	*Nga-mahi* ..	"Silvery fish" in reference to the colour of the abdomen.	Bony, not bitter.
	Family NANDIDAE.			
52	*Badis badis* (Ham. Buch).	*Pona* ..	"Deep-black" ..	....
	Family MASTACEMBELIDAE.			
53	*Rhynchobdella dhanashorii*, sp. nov.	....	....	....
54	*Mastacembelus manipurensis*, sp. nov.	*Nga-rin* ..	"Snake-fish" ..	Fairly good eating. It is generally smoked.

Serial No.	Scientific names.	Local name.	Meaning of the local name.	Economic value of the species and other particulars.
	Family Ophiocephalidae.			
55	*Ophiocephalus harcourtbutleri*, Annandale.	*Nga-mu* ..	"Black fish" ..	Fairly good eating, very common in swamps, especially near the Loktak Lake.
56	*Ophiocephalus punctatus*, Bloch.	....	....	....

Besides those fish given in the table above, there are others that visit the valley only during the rains. For convenience of reference I give their vernacular names, but as they are not represented in our collection I am unable to give their scientific equivalents.

Nga-mu-poram.—Imported for sale in a dried condition from Silchar.

Sna-nga=gold fish.

Nga-cha-hu or *Nga-chau.*—This fish is dreaded by local fishermen, because even a mild injury inflicted by its spine causes the swelling of all lymphatic glands, while a deep wound results in fever which may last for two to three days. It is said to be good eating

Nga-khro-bi.—This literally means "a fish with its mouth on the under surface." It is said to have a large upper lip.

Muglang.—This fish, like *nga-noi*, has a red operculum, caudal fin, belly, and streak of the same colour along the dorsal surface. Manipuri cartmen gave me this name for *Rasbora rasbora* at Dimapur, but I had no opportunity of verifying their statements from any other sources.

Nga-thi=ugly fish.

Nga-pa-hi.—The fish is said to hop like a sparrow.

Nga-hi=boat fish, in reference to its form like the Manipuri dugout.

Nga-len.—From *lenghba*=one that does not move. A remarkable account of the method of capture was given to me. The Mohammedan fishermen who alone capture and eat this fish dive and search for it under water. On discovering a fish, they come out and take a rope with them and dive again to the same place. They tie the rope round the tail of the fish being always careful not to touch its belly as this immediately disturbs it. The rope is now taken on shore and two or three people drag the fish out. It is said to be the most powerful fish in the valley.

For the following names I have no explanation:—*Nga-san*; *Nga-ril*; *Nga-chik*; *Nga-na-hi*; ; *Nga-nal*; *Nga-tin-charo*; *Nga-rel.*

The Manipuris do not take any other animal diet but fish, and practically all species found in the valley, except the *Nga-puram* and the *Nga-len*, to which they have a religious objection, are eaten. All are said to be more or less "bitter," when compared with the dried fish imported in large quantities from Sylhet, Cachar and from various other places. Below I have arranged the fish according to their food value as determined by Manipuris.

Good eating.—*Khabag*; *Sarin-khoi-bi*; *Sáreng*, *Nga-chep*; *Nga-rang*; *Nga-pang*; *Nga-chau*; *Nga-wa*.

Fairly good.—*Nga-rin*; *Nga-mu*; *Nga-kara*; *Nga-tin*; *Nga-mu-sangum*.

Fairly good but bony.—*Nga-tol*; *Nga-rohi-mapi*.

Very bitter.—*Hura*; *Nga-kha*; *Nga-sang*; *Nga-rohi*.

Smoked before eating.—*Nga-kshrou*; *Nga-nap*; *Nga-rin*; *Nga-tup*.

The fish sold fresh in the markets are:—*Nga-mu*; *Nga-kara*; *Nga-tin*; *Nga-chep*; *Sareng*.

Of these the first two are very common and are sold in a living condition in the market. The rest of the species except *Sareng* are also brought to the market dried. The major part of the freshfish sold in Imphal comes from Waithu-pat and the dried fish are mostly from the Thanga Island.

SYSTEMATIC DESCRIPTION OF THE COLLECTION FROM THE MANIPUR VALLEY AND THE NAGA HILLS.

Order SYMBRANCHOIDEA.

Family SYMBRANCHIDAE.

Monopterus albus (Zuiew).

1916. *Monopterus albus*, Weber and Beaufort, *Fishes Indo-Austr. Arch.*, III, p. 413, figs. 210, 211.

1918. *Monopterus albus*, Annandale, *Rec. Ind. Mus.*, XIV, p. 42.

Monopterus albus is found all over southern Asia east of the Bay of Bengal; its range extends to northern China and Japan.

The fish is only found buried in mud at the edge of the Loktak Lake. Some specimens were also found in the rice-fields in partially dried ponds. It is eaten by Nagas but not by Manipuris, who have certain religious scruples regarding the species. The Nagas, like the Inthas in the Inlé Lake, capture the fish with a two-pronged spear.

Cormorants, judging from the contents of their stomachs, seem to feed largely on this species.

Order OSTARIOPHYSI

Family SILURIDAE.

Clarias batrachus (Linn.).

1913. *Clarias batrachus*, Weber and Beaufort, *Fishes Indo-Austr. Arch.*, II, p. 190, fig. 74 (p. 187).
1918. *Clarias batrachus*, Annandale, *op. cit.*, p. 43.

This species is common everywhere in the valley, especially in and about the Loktak Lake. In the market it is usually sold in a living condition. Though the fish is very common in the swampy portion of the lake, it is also fairly abundant among the weeds further inwards. It does not grow to a very large size in the valley.

Adults are black in colour, but not quite so dark as young individuals. There are minute white spots forming distinct rows all over the body. The pectoral spine is roughened externally and finely serrated along its posterior border.

All the specimens in our collection are from the Loktak Lake.

Wallago attu (Schn.).

1889. *Wallago attu*, Day, *Faun. Brit. Ind. Fish.*, I, p. 126 fig. 54.
1889. *Wallago attu*, Vinciguerra, *Ann. Mus. Stor. Nat. Genova*, (2) IX, p. 199.

This was the biggest fish brought to the Manipur market at the time of our visit. Waithu-pat, a lake on either side of the Burma Road some 10 miles from Imphal, is particulary noted for this species.

It is found throughout India, Burma and Ceylon.

Callichrous bimaculatus (Bloch).

1889. *Callichrous bimaculatus*, Day, *op. cit.*, p. 131, fig. 57.
1889. *Callichrous bimaculatus*, Vinciguerra, *op. cit.*, p. 201.
1919. *Ompok bimaculatus*, Jordon and Starks, *Ann. Carnegie Mus.*, XI, p. 434.

Young specimens of this species are very difficult to distinguish from those of *C. macrophthalmus* (Blyth). In the identification of the Manipur specimens I have followed Vinciguerra, though an examination of the collection in the Indian Museum has shown that much reliance cannot be placed on the character of the vomerine teeth.

The specimens in the collection were obtained from Imphal and Khurda streams and from the Loktak Lake. There is a great variation in colour even in specimens from the same locality Some are silvery-white all over the body with a black blotch on either side above the pectorals; while in others the body is densely covered with minute black spots on a dull-white background, and the mark above the pectorals is not distinct.

In the valley *C. bimaculatus* does not reach a larger size than 9 to 10 inches.

Macrones[1] bleekeri, Day.

1880. *Macrones bleekeri*, Day, *op. cit.*, p. 162.
1880. *Macrones bleekeri*, Vinciguerra, *op. cit.*, p. 219.

The adipose fin of this species has a very great resemblance to that of *M. cavasius* and *M. leucophasis*. The difference between the three species may be expressed in a table as follows :—

M. cavasius (H.B.).	*M. leucophasis* (Blyth).	*M. bleekeri*, Day.
Maxillary barbels reach the caudal fin.	Maxillary barbels reach the anal fin.	Maxillary barbels reach the anal fin.
A black spot at the base of the first dorsal spine.	The head and fore part of the body bright silvery-white; no black spot at the base of the first dorsal spine.	Light longitudinal bands along the body; sometimes with a black shoulder spot. In the Burmese examples a black spot is also present at the base of the caudal fin.
Depth of body $5\frac{1}{2}$ times in the total length.	Depth of body $4\frac{1}{2}$ times in the total length.	Depth of body $5\frac{1}{2}$ times in the total length.
No interneural bone.	An interneural bone present.	No interneural bone.

The fish is very common all over the valley and is captured in large numbers in traps, both in the streams and the lakes.

The specimens from the Loktak Lake are darker in colour.

Subgenus Macronoides, nov.

This new subgenus is proposed for species which differ from typical *Macrones* in the possession of a distinct ventral mouth bordered by fringed lips; in having short barbels not exceeding the length of the head; in the mandibular pairs of barbels being disposed in a transverse row across the mandible and in the possession of a number of open pores on the ventral surface of the head just behind the mouth. In general facies the fish of this subgenus show a remarkable resemblance to those of the genus *Gagata*, from which, however, they are easily distinguished by the crescentic band of teeth and a free air-bladder in the abdominal cavity.

I assign the following species to the new subgenus :—*Macrones affinis* (Blyth),[2] *M. dayi* Vinciguerra[3] and *M. marianicnsis* Chaudhuri.[4] I have examined the types of the first and the third; while Vinciguerra's description and figures of *M. dayi* leave no doubt as to its affinity with the other two.

[1] Jordan, *Proc. Acad. Nat. Sci. Phil.* LXX, p. 341, considers *Macrones* a synonym of *Aoria*; but in view of the familiarity of the name *Macrones*, I have retained it in this paper.

[2] Blyth, *Journ. As. Soc. Bengal*, XXIX, p. 150 (1860).
Vinciguerra, *op. cit.*, p. 230, pl. vii, fig. 3 (1889).

[4] Chaudhuri, *Rec. Ind. Mus.*, VIII, p. 253, pl. xi, figs. 1, 1*a*, *b* (1913).

The subgenus *Macronoides* is distributed in Burma, the Abor Hills and the Manipur Valley.

Macrones (Macronoides) affinis (Blyth).

1860. *Batasio affinis*, Blyth, *op. cit.*, p. 150.
1889. *Macrones blythii*, Day, *op. cit.*, p. 151.

The fishermen of Manipur do not make any distinction between this fish and *Gagata cenia*, both of which are called *nga-rang*. The body is dotted with black spots which are aggregated in certain regions to form 3 or 4 indistinct vertical bands. Both the adipose and the spiny dorsal are edged with black. The alimentary canal is simple and has only two coils in its entire length.

Reference may be made to the importance which has been attached to the number of serrations on the pectoral spine. I have, however, found on examining a large number of specimens that the number of serrations is variable not only in different individuals, but even in the spines of the two sides of the same specimen.

There are four specimens from Amambi stream near Karam Lakai, about 8 miles from Imphal on the Burma Road.

M. affinis is known from Burma and the Manipur Valley.

Glyptothorax dorsalis, Vinciguerra.

1889. *Glyptothorax dorsalis*, Vinciguerra, *op. cit.*, p. 246, pl. vii, fig. 4.

There are ten specimens of this species, five from the Imphal stream and the rest from Amambi stream, some eight miles from Imphal on the Burma road.

The maxillary barbels reach the posterior margin of the base of the pectoral fin; the upper surface of the head and body is tuberculated, the tubercles being arranged in longitudinal rows. The dorsal spine is roughened externally and is smooth along its inner border; that of the pectoral fin is flattened and has 11 denticulations internally.

Most of the female specimens are full of eggs.

The species is known from Burma and the Manipur Valley.

Glyptothorax minutus, sp. nov.

D. 1/6. A. 3/9.

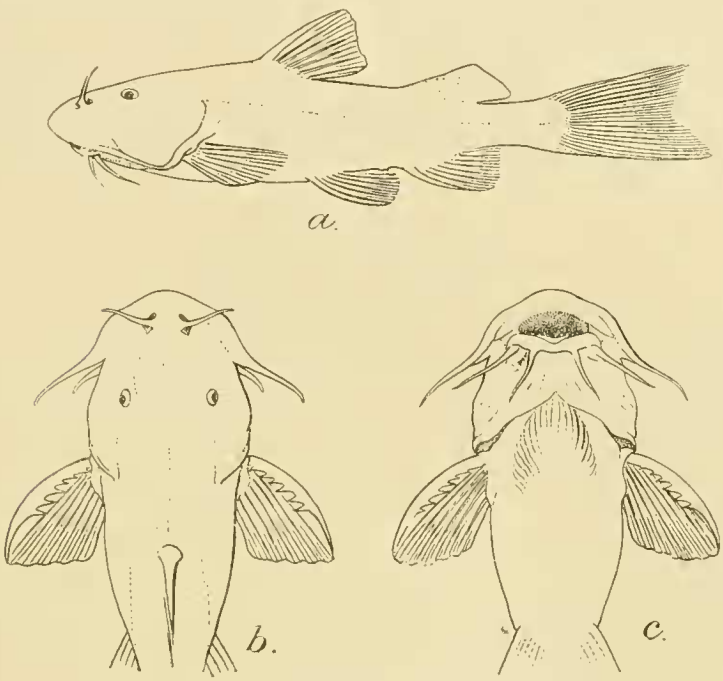
The length of the caudal fin is contained 5—$5\frac{1}{4}$ times, the depth of the body $5\frac{1}{3}$—6 times and the length of the head $5\frac{1}{2}$—$5\frac{3}{4}$ times in the total length including the caudal fin. The head is $1\frac{1}{4}$ times as long as broad. The eyes are minute, situated in the beginning of the posterior half of the head, they are dorso-lateral in position and are not seen from the ventral surface. *Barbels.*—The maxillary pair reach the base of the pectoral, the nasals reach the eye, the inner mandibular reach the anterior

margin of the adhesive apparatus and the outer the gill membrane.

Fins.[1]—The adipose fin is well developed; both the dorsal and the pectoral fins have loose folds of skin at their bases, the spine of the former is smooth while that of the latter is smooth externally and has six denticulations internally. The lower lobe of the caudal fin is slightly the longer.

The adhesive apparatus is U-shaped and is fairly well developed.

Colour.—The dorsal surface is dark, while the belly and the undersurface of the head are white; there are conspicuous black



Text-fig. 1.—*Glyptothorax minutus*, sp. nov.
(*a*) Lateral view of adult fish, × 2½.
(*b*) Upper view of head of same, × 3.
(*c*) Lower view of head of same, × 3.

bands at the bases of all the median fins; the caudal is grey and the paired fins are colourless. A V-shaped whitish area is also present at the base of the dorsal fin.

Four specimens were obtained from the Imphal stream near Karong. Manipuris do not make any distinction between this species and the preceding one.

[1] In giving the formula of the fin rays, I have attached great importance to the number of branched rays both in the dorsal and the anal fins. In the descriptions of the new species I have omitted the number of fin-rays in the caudal fin, because it is very difficult to count the smaller rays on either side after the longest ray. I have included, however, the length of the caudal fin in the total length.

Originally I regarded these specimens as the young of *G. dorsalis*, but on dissection I found the females full of eggs. Besides the smaller size, the species is distinguished from *G. dorsalis* by differences in the proportions of the body, the colouration and by the number of denticulations on the pectoral spine.

The largest specimen is 36 mm. in length.

Unfortunately the specimens are lost; but the figures clearly show all the features.

Gagata cenia (Ham. Buch.).

1889. *Gagata cenia*, Day, *op. cit.*, p. 208, fig. 75.
1889. *Gagata cenia*, Vinciguerra, *op. cit.*, p. 240.

This species is always confused by Manipuris with *Macrones* (*Macronoides*) *affinis*.

All the specimens from Manipur are young; they were only found in the Imphal and the Amambi streams.

The species is widely distributed in the waters of the Ganges and the Irrawadi.

Family CYPRINIDAE.

Psilorhynchus sp., Hora.

Plate IX, figs. 6, 6*a*.

1920. *Psilorhynchus* sp., Hora, *Rec. Ind. Mus.*, XIX, p. 211.

A few young specimens were collected in a small hill-stream at Piphima, Naga Hills.

Garra (Ham. Buch.).

Three species of this genus were discovered in the Manipur Valley and the Naga Hills by the survey party and myself. Of these two are represented by a large series in our collection while the remaining one, which is new, is known from a single specimen. In Mr. Pettigrew's collection there are three specimens of this genus. They represent another undescribed form.

The discussion on these species is given in another paper in which I am publishing a revision of the genus *Garra*. The names that I propose to give to the new species are included in the list for the sake of completeness.

Labeo calbasu (Ham. Buch.).

1889. *Labeo Calbasu*, Day, *op. cit.*, p. 259, fig. 93.
1889. *Labeo calbasu*, Vinciguerra, *op. cit.*, p. 265.

Only one specimen, 28·5 cm. in length, was obtained; it was captured in Khurda stream near its origin from the Loktak Lake.

The fins are much elongated. The ventrals are longer than the pectorals and reach beyond the base of the anal, which in turn extends beyond the base of the caudal fin. The dorsal fin has a fairly long base.

The colour is black all over except the under surface of the head and chest, which is dirty white.

Labeo pangusia (Ham. Buch.).

1889. *Labeo pangusia*, Day, *op. cit.*, p. 206.
1913. *Labeo angra*, Chaudhuri, *Rec. Ind. Mus.*, VIII. p. 249.

The specimens of *L. pangusia* from Manipur have a black blotch at the base of the caudal fin and are apt to be confused with those of *L. angra*. They can be distinguished from the latter species by the possession of definite barbels instead of the maxillary flaps inside the grooves, one on either side of the mouth, and in having a triangular black spot just above the fifth scale of the lateral line. The structure of the mouth and lips of the two species is also different.

Labeo pangusia is common in the streams of the valley and three specimens were collected from the Loktak Lake. The lake specimens are darker in colour.

Labeo angra (Ham. Buch.).

1889. *Labeo angra*, Day, *op. cit.*, p. 267.
1889. *Labeo angra*, Vinciguerra, *op. cit.*, p. 273.

The specimens of this species agree with Burmese examples in our collection. They possess a fleshy flap inside the groove instead of the maxillary barbels on each side of the mouth. There is a deep black blotch at the sides of the tail. In certain young individuals there is also an indication of a second blotch above the middle of the pectoral fin.

The specimens in the collection were found in the muddy streams of the Manipur Valley.

Crossochilus latia (Ham. Buch.).

1889. *Cirrhina latia*, Day, *op. cit.*, p. 279.
1889. *Crossochilus latius*, Vinciguerra, *op. cit.*, p. 280.
1918. *Cirrhina latia*, Annandale, *op. cit.*, p. 46.

This fish is found in abundance in the muddy streams of the valley, and does not exceed 7 inches in length.

The young specimens are slender in form and look somewhat different from the adults. Manipuris call the young *nga-rohi* and the adults *nga-rohi-mapi*, "the mother of *nga-rohi*."

This is one of the commonest species found in the streams of the Manipur Valley.

Barbus sarana caudimarginatus, Blyth.

1860. *Barbus caudimarginatus*, Blyth, *op. cit.*, p. 157.
1918. *Barbus sarana caudimarginatus*, Annandale, *op. cit.*, p. 46.

The species is fairly common in the Imphal River and its tributaries and is also found in the Loktak Lake. The lake specimens are, however, darker in colour.

Barbus oatesii, Boulenger.

1893. *Barbus oatesii*, Boulenger, *Ann. Mag. Nat. Hist.* (6) XII, p. 201

Annandale[1] regarded this species as being synonymous with *Barbus sarana caudimarginatus*, Blyth, after comparing his specimens from the Inlé Lake with a cotype of Boulenger's *oatesii* and as a result of his examination of a series of specimens of *B. sarana* from India and Burma in the collection of the Indian Museum. In identifying my specimens I have referred to the same sources, and am convinced after a careful examination of the large series, that *B. oatesii* is a distinct species and that Annandale's own specimens undoubtedly belong to the true *B. sarana caudimarginatus*.

The most important difference between the two species is in the structure of the dorsal spine In *B. oatesii* it is strong and very strongly serrated, with 12 to 19 serrations on each margin of its posterior border. The serrations along the two margins of the spine are very close together and become longer and stronger from below upwards. In *B. sarana caudimarginatus* the spine is strong but finely serrated only in its upper half or two-thirds, the serrations are subequal. Along the posterior aspect, the spine is deeply grooved and the serrae are situated on its margins ; their number is indefinite. The colour of the two species is also different. In both the forms, however, the opercular cleft has a black edge, which probably led to the confusion of the two species. In *B. oatesii*, as Boulenger observed, each scale is edged with black. This condition is not so well-marked in the cotype examined by Annandale, because the colour has become very faint on account of the specimen having been in spirit for over a quarter of a century. There can be no doubt regarding the colouration of the young specimens collected by me in Thaubal stream about a mile from Phaidai. Under a lens the black edge is seen to consist of minute black dots which are more closely aggregated along the anterior border of the scale.

The caudal fin is also different in the two species. In *B. oatesii* it is long and deeply notched, the lower lobe being broader and longer. In *B. sarana caudimarginatus* the caudal fin is relatively shorter in length, and is not so deeply notched. The two lobes are equal in length.

The proportions are also different in the two species.

In young specimens the length of the caudal fin, the depth of the body and the length of the head are almost equal and are contained $4\frac{1}{2}$—$4\frac{2}{3}$ times in the total length. The caudal fin is very brittle and is broken in most specimens. The following are the measurements of two complete young individuals :—

	A.	B.
Total length including caudal ..	53 mm.	57 mm.
Length of caudal	11 ,,	13 ,,
Depth of body	11 ,,	12·3 ,,
Length of head	12 ,,	12·7 ,,

[1] Annandale, *Rec. Ind. Mus.*, XIV, p. 46 (1918).

B. oatesii is now known from the S. Shan States and the Manipur Valley.

Barbus clavatus, McClelland.

Plate IX, fig. 1.

1845. *Barbus clavatus*, McClelland, *Calcutta Journ. Nat. Hist.*, V, p. 280, pl. xxi, fig. 2.
1868. *Barbus clavatus*, Günther, *Cat. Fish. Brit. Mus.*, VII, p. 97.
1878. *Barbus clavatus*, Day, *Fish. India*, II, p. 500.
1889. *Barbus clavatus*, Day, *op. cit.*, p. 300.

There has been some confusion between *Barbus chagunio* (Ham. Buch.), *B. spilopholus*, McClell. and *B. clavatus*, McClell. At first McClelland [1] considered *B. chagunio* to be "a variety of the spotted barbel, *B. spilopholus*," but later in describing *B. clavatus* he remarked that "the collection now before us, affords, however, a very distinct species, which I believe to be the *Cyprinus chagunio*, Buch." Günther regarded McClelland's two species as distinct, but placed *Cyprinus chagunio* with a query under the synonymy of *B. clavatus*. Day recognised *B. chagunio* as a distinct species and regarded *B spilopholus* as its variety; he moreover considered *B. clavatus* as a distinct species. Chaudhuri [2] recognised *B. spilopholus* as a valid species, but had no material to decide about *B. clavatus* as it was then only known from McClelland's description which is unfortunately imperfect and meagre and some casual remarks in it are misleading; his figure of the species is also poor.

I take this opportunity to supply a short description and a figure of the species from a few well-preserved examples collected in Senapati stream near Kairong, Naga Hills, Assam.

D. 4/8. A. 3/5. P. 14—15. V. 8—9.

The length of the caudal fin equals the depth of the body which is contained 4—$4\frac{1}{2}$ times in the total length. The head is short and conical, its length being contained 5—$5\frac{3}{4}$ times in the total length; it is comparatively longer in young specimens than in the adult. The snout is shorter than the diameter of the eye, which is contained about 3 times in the length of the head. The caudal peduncle is $1\frac{3}{4}$—2 times as long as broad. *Fins.*—The origin of the dorsal is almost in the middle of the distance between the end of the snout and the base of the caudal fin, in some individuals it is nearer to the former. Its last spine is denticulated posteriorly and is almost as high as the depth of the body below it. The free margin of the fin is deeply concave. The caudal fin is very long and deeply forked, its rays are very brittle. *Scales.*—There are 40—42 scales along the lateral line, 7—8 rows of scales above it and $3\frac{1}{2}$—$4\frac{1}{2}$ below it to the base of the ventral fin. In an oblique line there are in all 11 rows between the bases of the dorsal and the ventral fins. There are 14

[1] McClelland, *Asiat. Resear.*, XIX, pp. 277 and 341 (1839).
[2] Chaudhuri, *Rec. Ind. Mus.*, VIII, p. 250, pl. viii, figs. 1, 1*a*, *b* (1913).

scales in front of the dorsal. *Barbels.*—Both pairs of barbels are well developed Maxillary barbels are longer than the rostrals and are as long as the diameter of the eye.

The vent is much nearer the base of the caudal fin than the end of the snout.

The mouth is semicircular ; its opening extends to the anterior border of the orbit. There are two rows of open pores on the under surface of the head. The snout is usually tuberculated, but in young individuals these tubercles are not developed.

The fish is blackish blue in the region above the lateral line, below it the sides and the ventral surface are dull white. The membranous portions of the skin between the rays of the dorsal fin are black in colour. The caudal along its superior and inferior margins is edged with black. The young specimens are brighter in colour and possess an obscure blotch at the base of the caudal fin. In some specimens the scales along the lateral line and of a few rows above and below it are covered by minute black spots, forming longitudinal bands along the side

Barbus clavatus is found in rivers at the foot of the Sikkim mountains on the northern frontier of Bengal and in the Naga Hills at Kairong.

Barbus hexastichus, McClelland

1889. *Barbus hexastichus*, Day, *op. cit.*, p. 308.
1889. *Barbus hexastichus*. Vinciguerra, *op. cit.*, p. 291.

Three grown up specimens were obtained at Kairong. They possess an indistinct black spot on either side of the tail. This character is best marked in the young fry collected at various places in small streams in the Naga Hills and also in Itok stream near Chanderkhong in the Manipur Valley.

Barbus tor (*s l.*) (Ham. Buch.).

Only one specimen of this species was obtained from Senapati stream near Kairong, Naga Hills. The lips in the example are well developed and are provided with thick adipose growth

Barbus tor is a composite species and I hope to deal with its races and species in a separate paper when sufficient material from various localities is available.

Barbus conchonius (Ham. Buch.).

1889. *Barbus conchonius*, Day, *op. cit.*, p. 325.

Numerous specimens of this species were collected in lakes and streams all over the valley.

Barbus phutunio (Ham. Buch.).

1889. *Barbus phutunio*, Day, *op. cit.*, p. 327.

Numerous specimens of *Barbus phutunio* were collected from the Residency ponds, Imphal. The following description of the

colour of the living specimens was noted down by Dr. Annandale in the field-book :—" The dorsal surface brownish, deeply tinged with metallic green and dotted with black, sides metallic crimson, each scale edged with black ; ventral surface silvery; pelvic, anal and caudal fins crimson ; dorsal and pectoral bright olivaceous green with the rays more or less infuscated and with black spots on the dorsal. Iris crimson, lower part of the cheek and operculum silvery white densely speckled with black."

S. Dogar Singh informed me that these fish were introduced into the Residency ponds from outside the Manipur Valley on account of their beautiful colouration.

Barbus ticto (Ham. Buch).

1880. *Barbus ticto*, Day, *op. cit.*, p. 325.

This is the commonest fish in the valley and is daily captured in large quantities with baskets.

Rasbora rasbora (Ham. Buch.).

1880. *Rasbora buchanani*, Day, *op. cit.*, p. 337, fig. 107.

Only two specimens were captured from the Dhanashori stream, near Dimapur, Assam. In both specimens the scales have been rubbed off leaving the black edged membranes behind. The caudal fin is tipped with black as in the Burmese examples.

Rohtee, Sykes.

Some ichthyologists have adopted the generic name *Osteobrama*, Heckel, in preference to *Rohtee*, Sykes, probably owing to a confusion as to the dates of publication of the works of Heckel and Sykes. Günther in his " *Catalogue of the Fishes in the British Museum*," VII, p. 322, gives 1842 as the date of publication of the two works and selects *Osteobrama*, with Sykes' genus *Rohtee* as a synonym. Vinciguerra (*op. cit.*, p. 313) in adopting the same course writes as follows :—" Ho adottato il nome generico di *Osteobrama*, a preferenza di quello di *Rohtee*, perchè, mentre essi sono di data sincrona, poichè il lavoro di Heckel in cui il primo è proposto (Russegger's Reisen I, p. 1033) fu pubblicato nel 1842 data che porta anche quello di Sykes, in cui è stabilito il secondo (Trans. Zool. Soc. Lond. II, p. 364), quello ha sull'altro il vantaggio di non essere barbaro come esso." I do not agree with the authorities quoted above and find that Sykes' work was published on 27th February, 1841 ; while Heckel established *Osteobrama* in 1843. According to the rules of priority, therefore, *Rohtee* must have preference over *Osteobrama*. Vinciguerra's second argument for adopting *Osteobrama* is purely sentimental and therefore needs no consideration.

Another point deserving some consideration is, as to whether

Hamilton Buchanan's[1] eighth subgenus "*Cabdio*" of his *Cyprinus* should be revived in place of *Rohtee* or not, as it includes *Cyprinus* (*Cabdio*) *cotio* which is now regarded as a *Rohtee*. On a careful analysis of the subject, however, I find that *Cabdio* can not replace *Rohtee* because the forms assigned to *Cabdio* by Hamilton Buchanan include species which have subsequently been assigned to several genera and Sykes (1841) was the first to separate some species, in practice if not in theory, for in describing *Rohtee ogilbii* he observes as follows:—"The *Rohtee* has the appearance of *Clupanodon chanpole* of Dr. Hamilton; also of *Cyprinus devario* in the outline of the body; and were it proper to consider it a *Cyprinus*, which its armed back-fin renders impossible, it would be placed in Dr. Hamilton's eighth subgenus '*Cabdio*.'" Sykes in making the above remark ignored the fact that Hamilton Buchanan's *Cyprinus cotio* had a spine of this nature. Further, of the four species included under *Rohtee* by Sykes, two *viz. Rohtee pangut* and *Rohtee tieto* are now invariably referred to the genus *Barbus*, while of the other two belonging to *Rohtee* (*s s*) neither was known to Hamilton Buchanan. From the statements of the two authors it is clear, therefore, that *Cyprinus cotio* is congeneric with *Rohtee*, Sykes, which may stand for these and other similar species. I am highly indebted to Dr. N. Annandale and Dr. B. L. Chaudhuri for valuable suggestions on this point.

Rohtee alfrediana (C. and V.)

1889. *Osteobrama alfrediana*, Vinciguerra, *op. cit.*, p. 310.

The specimens of this species were collected in Khurda and Thaubal stream; the longest is 109 mm. in length. In young individuals the body is less deep and an indistinct black band is usually present behind the gill cover.

Rohtee belangeri (C. and V.)

1889. *Osteobrama belangeri*, Vinciguerra, *op. cit.*, p. 318.

This species is distinguished from the rest included in the genus *Rohtee* by the fact that the whole of the abdominal edge is sharp, whereas in others it is sharp behind the ventrals but flat and rounded in front of them. Moreover, the pharyngeal teeth in this species are armed with tubercles on their crowns; this character is shared by *R. ogilbii*.

It will not be out of place to make some observations on the nature of the pharyngeal teeth here. In a former paper by Annandale and myself[2] a reference was made to the occurrence of loose teeth in the muscles surrounding the pharyngeal bones. Having had the opportunity to dissect a large number of fish for these teeth, I find the loose teeth fairly common. In *R. belan-*

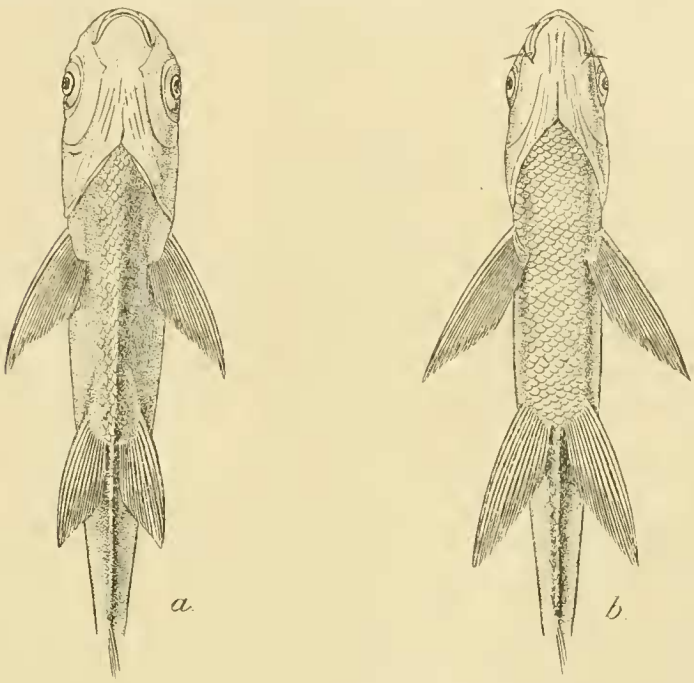
[1] Hamilton Buchanan, "*An account of the Fishes in the Ganges*," pp. 333 and 392 (1822).

[2] Annandale and Hora, *Rec. Ind. Mus.*, XVIII, p. 105 (1920).

geri their crown is crenulated like that of the fixed teeth and in all probability they represent the older teeth that have been cast off and their place being taken up by new ones. Dr. Annandale thinks it more probable that the free teeth are young and have not yet fused with the bone.

Two specimens of this species were obtained from the Manipur Valley, one in Loktak Lake and the other in the Khurda stream. The lake example is darker in colour.

This species occurs in Burma and Manipur. Its occurrence in the Godaveri River needs confirmation.



Text-fig. 2.—Ventral view of two species of *Rohtee*, Sykes.
(*a*) *Rohtee belangeri*, showing keeled abdomen throughout.
(*b*) *Rohtee feae*, showing keeled abdomen only between vent and base of ventrals.

Barilius bendelisis var. chedra (Ham. Buch.).

1889. *Barilius bendelisis* var. *chedra*, Day, *op. cit.*, p. 347.

This species is represented in our collection by seven specimens captured in the Senapati stream near Kairong, Naga Hills. The water of this stream was very clear and my attention was drawn to a fairly big specimen of this species, which showed beautiful colour and special mucous bands on certain parts of the body. The fish was very sluggish in habit and we followed it from place to place till it was secured in an ordinary hand net. Out of water the mucous bands were not so distinct and in spirit have

left those particular portions of the fish lighter in colour. The colour of the fresh specimens is thus described in the field-book :—" The caudal fin and the apex of the dorsal dusky ; other fins pinkish. The general surface silvery, with a black triangular spot at the base of each scale ; the cheeks yellow ; the operculum golden or deep orange with black borders."

The paired fins are broad and well-expanded and most of the outer rays in them have become stiff. The chest is flattened and the scales in this region are poorly developed. There are characteristic muscular pads in front of the bases of the pectorals. The open pores on the snout are absent.

Barilius bendelisis var. *chedra* is found along the base of the Himalayas.

Barilius barila (Ham. Buch.).

1889. *Barilius barila* Day, *op. cit.*, p. 348.

The character of the barbels on which Day has based his synopsis of the species of this genus is faulty : not only because the barbels are very small, but also because they are liable to be overlooked owing to their being hidden underneath folds of skin. In the Manipur examples both pairs of barbels are present, the rostral pair being slightly longer than the maxillary. There are 22 rows of scales in front of the dorsal fin The chief character on which I have based the identification of this species is the inequality of the two lobes of the caudal fin ; the lower lobe being slightly the longer. This character is more marked in young individuals.

Barilius barila exhibits considerable variations with age and locality. In young individuals the pectorals do not reach the ventrals, nor the latter, the anal, and the origin of the dorsal is equidistant from the middle of the eye and the base of the caudal fin. With the growth of the fish, especially in hill-streams, the paired fins become much expanded and the area in front of the pectorals is specialized as in *B. bendelisis* var. *chedra*. In a specimen about 13 cm. long, the pectorals extend beyond the ventrals and the ventrals reach the anal, and the dorsal is equidistant from the hinder edge of the eye and the base of the caudal fin.

The vertical blue bands on the body are better marked in young specimens than in the adults. I have the following note in the field-book about the colouration of a living specimen from the Sikmai stream :—" Upper surface dark olivaceous, sides silvery with blue bands extending to the lateral line ; fins pinkish ; iris deep orange ; opercular piece dark while the rest of the gill-cover orange."

A specimen from the Khurda stream is of special interest, because it lacks the ventral fins. The absence of the ventrals has been considered to be a character of generic importance, but in the case of this specimen I consider it an abnormality, as it is impossible to separate this individual on any other character from *B. barila*, of which I have examined a large series.

The following are the measurements of the unique specimen :—

Total length including caudal	..	..	94·0 mm.
Depth of body	..	..	18·5 ,,
Length of head	...	..	19·0 ,,
Diameter of eye	..	..	6·0 ,,
Length of snout	..	..	5·5 ,,
Interorbital width	..	..	6·3 ,,
Length of rostral barbels		..	2·0 ,,
Length of maxillary barbels	..	..	1·5 ,,

The species is widely distributed in the streams of the valley. A few specimens were taken in the Senapati stream near Kairong in the Naga Hills.

Barilius dogarsinghi, sp. nov.

D. 2/7. A. 3/9. P. 13. V. 8.

The length of the head is contained 5—5⅓ times, the depth of the body 4—4⅓ times, the length of the caudal 5 times in the total length including the caudal fin. The eyes are situated somewhat in the anterior half of the head, their diameter being contained 4 times in the length of the head, 1¼—1½ times in the length of the snout and 1¼ times in the interorbital width. *Barbels.*—There are two pairs of short barbels. *Scales.*—There are 38—39 scales along the lateral line, 7—8 rows above it to the base of the dorsal fin and 3 below it to the base of the ventrals. There are 20 rows of scales in front of the dorsal fin. *Fins.*—The origin of the dorsal is equidistant from the end of the upper lobe of caudal and the anterior margin of nares. It is situated far back and extends to about the middle of the anal fin. The paired fins are well developed and possess a number of stiff rays. The pectorals do not reach the ventrals, which in some examples extend to the base of the anal fin. The auxiliary processes do not go beyond the bases of the pectorals. The free margins of both the dorsal and the pectoral fins are rounded. The lower lobe of the caudal fin is slightly longer than the upper.

The mandibular knob so characteristic of the genus is absent in this species.

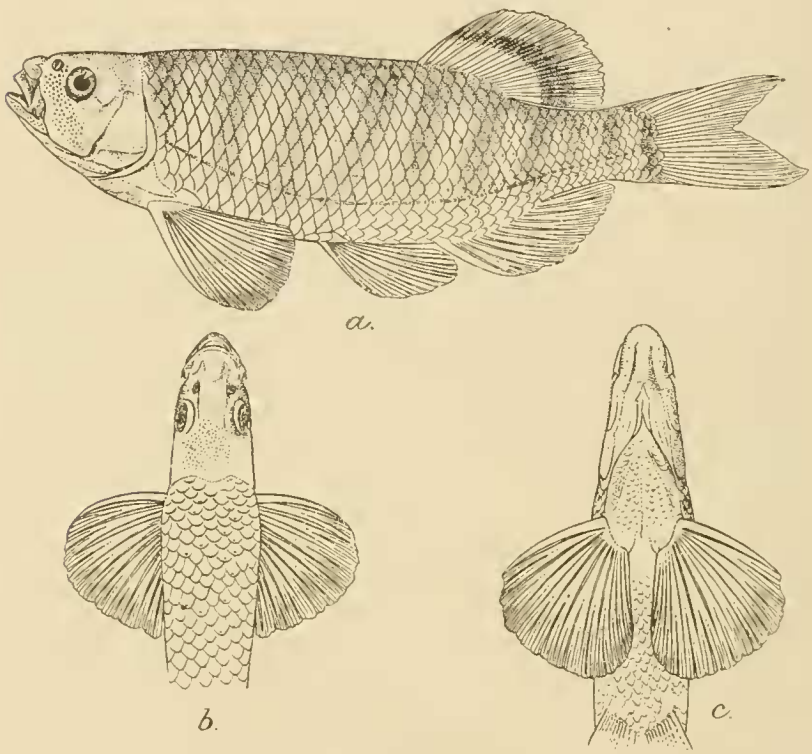
The dorsal profile in front of the dorsal fin is almost straight, but posteriorly it curves to the base of the caudal fin. The ventral profile is deeply arched and is convex throughout. The skin on the sides of the head is prominently tuberculate.

Colour.—The dorsal surface of the head and body is black with about 9 blue lateral bands. The band at the base of the caudal fin is deeper in colour than the rest. The belly and the under surface of the head, and the pectoral, the anal and the ventral fins white. The caudal is dusky in its posterior half, and the dorsal has a characteristic deep black band across its middle.

The young individuals have longer barbels, a smooth snout and normal paired fins, and the band at the base of the caudal fin shows a deep black spot in its centre.

As in the preceding species, I find that in one example the ventral fin of the left side is absent and the surface is covered with scales in the region from which the fin is lacking.

A specimen 85 mm. in length was found on dissection to contain eggs.



Text-fig. 3.—*Barilius dogarsinghi*, sp. nov.
(*a*) Lateral view of type-specimen (slightly enlarged).
(*b*) Dorsal view of head of same (slightly enlarged).
(*c*) Ventral view of head of same (slightly enlarged).

I have great pleasure in associating this fish with the name of my friend S. Dogar Singh, State Overseer at the time of our visit to Manipur, who toured in the valley with me and helped me in various other ways.

Type-specimen.—F 9983/1. *Zoological Survey of India* (*Ind. Mus.*).

Twelve specimens of this species were captured in the Etok stream near Chanderkhong and one young individual in the Sikmai stream near Palel.

Barilius dogarsinghi is quite distinct from the rest of the species included in the genus in the form and position of the vertical fins and in its general facies. It might perhaps be regarded as the type of a new genus or subgenus, but, for the present at any rate, I prefer to place it in *Barilius*.

Danio dangila (Ham. Buch.).

1889. *Danio dangila*, Day, *op. cit.*, p. 356.
1889. *Danio dangila*, Vinciguerra, *op. cit.*, p. 306.

Two specimens were found at Ghaspani (alt. 1500 ft.). The largest specimen is 58 mm. in length.

Danio dangila is found in Bengal, Bihar, Darjiling, Burma and the Naga Hills.

Danio aequipinnatus (McClell.).

1889. *Danio aequipinnatus*, Vinciguerra, *op. cit.*, p. 304.

Specimens of this species were captured in various streams in the Naga Hills and three from a small hill-stream north-west of Potsengbaum and one from Itok stream near Chanderkhong.

I have the following note in the field-book on the colouration of a living specimen caught in a small stream near Ghaspani :—

"Three blue bands on either side—the one in the middle reaching the base of the caudal fin which is infuscated in the middle. Intervening between these blue bands are others of a yellowish-orange colour. The blue bands break up behind the operculum and form a characteristic pattern. There is a black spot behind the angle of the operculum and a golden streak runs along the dorsal surface. The fish is partially transparent with a dusky back and a white belly. The caudal and the pectoral fins are reddish; the dorsal is provided with a blue stripe. The remaining fins are of an orange colour."

Danio (Brachydanio)[1] acuticephala, sp. nov.

D. 2/6—7. A. 2—4/9.

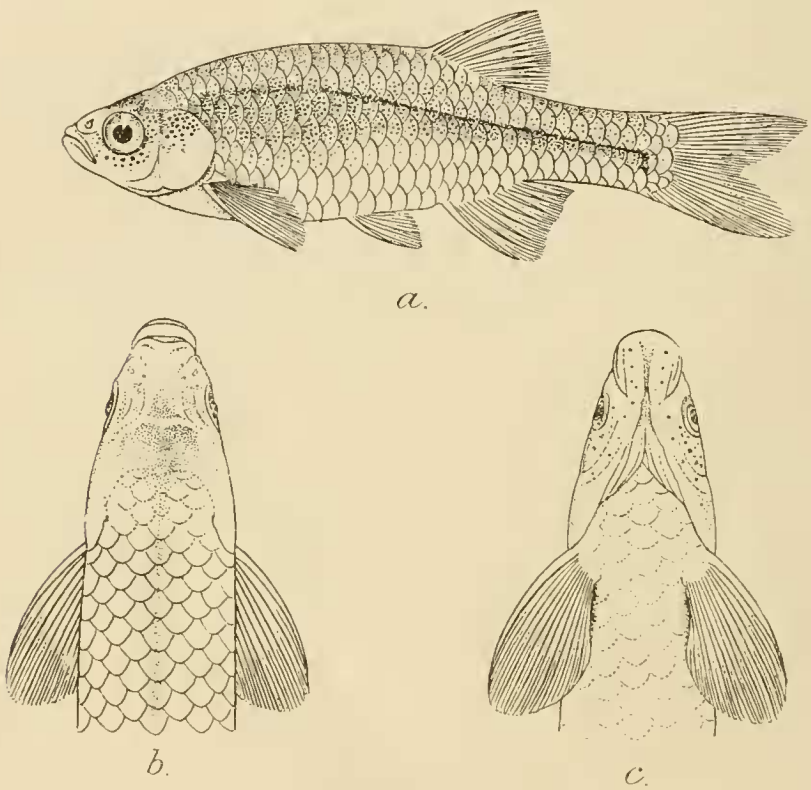
This little fish is fairly stout and deep and has a characteristic facies, being highest in the middle and tapering towards both ends. The head is short and pointed. The eyes are prominent and are situated in the anterior half of the head. The mouth is small, semicircular and is turned upwards. The nostrils are placed midway between the antero-superior margin of the eye and the end of the snout. There are open pores distributed all over the head and those on the under surface are along the preopercular borders and the mandibles. In some specimens the pores are absent.

The dorsal fin is short with 6—7 branched rays, its origin is equidistant from the end of the snout and the hinder end of the

[1] Weber and Beaufort, *Fish. Indo-Austra. Arch.*, III. p. 85 (1916).

caudal fin. The pectorals are rounded and when adpressed do not reach the ventrals, which in turn do not extend to the base of the anal. The anal fin is truncate and its base is covered with a scaly sheath. The caudal fin is deeply emarginate both the lobes are pointed, the lower one slightly the longer. Both the pectoral and the ventral fins are provided with scaly appendants.

The length of the head is contained $4\frac{2}{3}$—5 times and the length of the caudal $4\frac{1}{4}$—$5\frac{1}{4}$ times in the total length including the caudal fin. The diameter of the eye is contained 3—$3\frac{1}{2}$ times



Text-fig. 4 *Danio (Brachydanio) acuticephala*, sp. nov.
(*a*) Lateral view of type-specimen, × 2.
(*b*) Dorsal view of head of same, × 3.
(*c*) Ventral view of head of same, × 3.

in the length of the head. There are 30 scales along the lateral line and 8 rows in an oblique line between the bases of the dorsal and the ventral fins

Colour.—In the specimens preserved in spirit the upper surface is dusky and the lower pale-olivaceous. A broad black longitudinal band is present on either side of the body and a black narrow streak is to be seen along the dorsal surface.

The colour of a fresh specimen from Bishenpur, Manipur, is thus described in the field book :—"Upper part of body dull olivace-

ous, speckled with black, dorsal surface of head and a narrow line extending all along the dorsal surface of the body, black. A metallic bluish line running along the middle of each side. Sides of head silvery speckled with black. Ventral surface as far as the vent, white and silvery. Lower part of body behind the vent tinged with salmon, fins white, minutely speckled with black and an obscure salmon stripe along the centre of the caudal."

Type-specimen.—F 9981/1. *Zoological Survey of India* (*Ind. Mus.*).

Danio acuticephala is widely distributed in the small streams and ponds of the valley. It does not occur in big muddy streams.

Measurements in millimetres.

	Type	A.	B.	C.	D.
Total length including caudal	44·8	42·4	29·7	39·2	41 5
Length of caudal ..	8·5	9·7	7·0	8·4	8·2
Depth of body ..	10·8	9·8	6·5	9·1	10 0
Length of head ..	9·3	8·8	6·4	7·9	8·3
Diameter of eye ..	2·6	2·5	2·1	2·3	2·5

Most of the female specimens were found to be full of eggs.

Family COBITIDAE.

Botia berdmorei (Blyth).

1860. *Syncrossus berdmorei*, Blyth, *op. cit.*, p. 166.
1889. *Botia berdmorei*, Vinciguerra, *op. cit.*, p. 345.

Numerous individuals of this species were collected in the Imphal River and its tributaries in the valley.

Vinciguerra points to the inconsistency as regards the number of barbels in Day's description of the species. I have examined the type-specimens and a large series of individuals from the Manipur Valley and in all I have been able to make out only six barbels, four of which are rostral and united at their base. The arrangement of the rostral barbels and the structure of the lower lip is very characteristic of the species.

The colour varies greatly. Usually there are 10—18 oblique transverse bands on the body and about 5 longitudinal rows of black dots. The upper surface of the head is black, with two black streaks running from the eye to the snout. The belly and the under surface of the head are white. In one specimen the body was uniformly pale except for light bands on the caudal fin.

Botia berdmorei occurs in Burma and the Manipur Valley.

Botia histrionica, Blyth.

1860. *Botia histrionica*, Blyth, *op. cit.*, p. 166.
1889. *Botia histrionica*, Vinciguerra, *op. cit.*, p. 346.

Only two specimens of this species were obtained from the Amambi stream. They are 118 and 153 millimetres in length.

The Manipur examples agree with Vinciguerra's description of the species except for a little variation in colour which is, otherwise, characteristic of the species. In the younger specimen the number of bands on the caudal and the dorsal fins are fewer in number and in the adult black dots are present between the vertical bands on the body.

Measurements in millimetres.

Total length (including caudal) ..	153	118
Length of caudal	32	25
Depth of body ..	30	21
Length of head ..	30	22
Diameter of eye	5	3·8
Length of snout ..	18	13
Height of dorsal fin	20	15
Length of pectoral	23	18
Length of caudal peduncle ..	21	12
Height of caudal peduncle ..	19·5	14

Botia histrionica is only found in Burma and the Manipur Valley.

Lepidocephalichthys guntea (Ham. Buch.).

1889. *Lepidocephalichthys guntea*, Vinciguerra, *op. cit.*, p. 339.

There is only one specimen of this species taken at Ghaspani (1527 ft.) at the base of the Naga Hills, Assam.

Lepidocephalichthys berdmorei (Blyth).

1889. *Lepidocephalichthys berdmorei*, Vinciguerra, *op. cit.*, p. 341.
1918, *Lepidocephalus berdmorei*, Annandale, *op. cit.*, p. 43.

This is the commonest loach in the valley being found everywhere, both in the muddy and the hillstreams of the valley. It was curious to note that not even a single specimen of this species was obtained in the Loktak Lake, whereas it was quite common in a sluggish muddy stream near Potsengbaum.

The chief character that distinguishes this species from the preceding one is the mandibular flap. The mandibular flap in *L. berdmorei* is thickened and pliated anteriorly while posteriorly it is produced into three or more short barbel-like processes.

Lepidocephalichthys irrorata, sp. nov.

Plate IX, figs. 5, 5*a*, 5*b*.

D. 2/7. A. 3/5. V. 1/6. P. 7—8. C. 15—16.

This comprises small fish with the body slightly compressed from side to side. The dorsal profile is slightly arched while the ventral is straight and horizontal throughout. The length of the head is contained $6\frac{2}{5}$—$7\frac{3}{5}$ times, the depth of the body

$6\frac{1}{3}$—$7\frac{1}{3}$ times in the total length including the caudal fin. The eyes are minute and are situated in the anterior half of the head. The suborbital spine is bifid, the posterior prong being longer and stronger. The mouth, which is situated on the ventral surface, is semicircular and is provided with thick lips. The vent is placed on a slightly raised papilla and is provided with thick lips, which are not continuous posteriorly. It is situated in the beginning of the posterior third of the distance between the base of the caudal fin and the eye. There are two nostrils on each side lying close together but separated by a valvular flap. The anterior nostril is oval while the posterior is rounded. *Barbels.*—There are eight barbels, two rostral pairs, one maxillary pair and one pair mandibular. The bases of the mandibular barbels are broadened outwards to meet those of the maxillary barbels and thus a membranous flap stretches between the bases of the mandibular and the maxillary barbels. In some individuals the membranes are wanting and all the barbels are free. Under the lens the barbels show spiny projections all over their surface. *Fins.*—The dorsal fin is almost as high as the depth of the body below it; its origin is considerably behind the ventrals and is much nearer to the base of the caudal fin than to the end of the snout. The origin of the ventral is equidistant from the end of the snout and the base of the caudal fin. The free posterior border of the caudal fin is concave. *Scales.*—The scales are minute and there are about 34 rows in an oblique line between the base of the dorsal and that of the ventral fins.

The specimens from the Loktak Lake have a characteristic colouration. They are pale olivaceous, more or less densely speckled with black There is a series of fine dark spots running along each side. On the dorsal surface and the sides of the head the dark specks are more closely aggregated The fins are whitish with numerous dark transverse bars on their rays; narrow, irregular pale bars are also to be seen on the dorsal surface. There is also a dark streak from the eye to the snout.

The specimens from other lakes and streams in the valley are of a uniform pale colour, with short bars across the back and a row of fine spots along the sides. The fins are banded or speckled with black dots.

Type-specimen.—F 9904/1. *Zoological Survey of India* (*Ind. Mus.*).

Lepidocephalichthys irrorata is widely distributed in the lakes and streams of the Manipur Valley.

Acanthophthalmus pangia (Ham. Buch.).

1889. *Acanthophthalmus pangia*, Day, *op. cit.*, p. 222.
1889. *Acanthophthalmus pangia*, Vinciguerra, *op. cit.*, p. 347.
1916. *Acanthophthalmus pangia*, Weber and Beaufort, *op. cit.*, III, p. 31.

In describing *Barilius barila* I referred at some length to an abnormal specimen in which the ventrals were totally absent and it

was pointed out that this character did not seem to me of either specific or generic value. The genus *Apua* is distinguished from *Acanthophthalmus* by the absence of the ventral fins. Vinciguerra does not recognise the genus *Apua*, but in doing so he does not assign any valid reasons. According to him "le ventrali fossero mancanti per pura accidentalitá o che per la loro estrema piccolezza sieno sfuggite all' osservazione di entrambi questi naturalisti." I have examined the two type-specimens (No. F $\frac{2.6.1.7}{1}$) of *A. fusca*, Blyth, but can find no trace of the ventrals in them; and cannot, therefore, agree with Vinciguerra when he says that the ventrals must either have been overlooked or accidentally broken in the unique type-specimens of the genus. I look upon these cases as abnormalities, though it is surprising that both the specimens should have lost the ventrals. I have already referred to an abnormal specimen of *Barilius dogarsinghi* in which the ventral fin of the left side is absent. I have also examined a specimen of *Rita rita*, in the collection of the Government College Museum, Lahore, in which the pectoral fin of one side is absent. In view of what I have stated above I do not regard *Apua* as a distinct genus.

There is another interesting observation which might be referred to in this connection. After a careful examination of a large collection of *A. pangia* from Manipur, I am of the opinion that the form hitherto known as *Apua fusca* is only a hill-stream phase of *A. pangia*. Vinciguerra distinguishes *A. pangia* from *A. fusca*, by the greater depth of its body, by the ventrals being placed midway between the base of the caudal and the middle or the posterior margin of the orbit, and by the position of the dorsal, which in *A. fusca* ends just above the origin of the anal fin. I have not been able to verify the above characters in the case of the type-specimens of *A. fusca*. In these specimens the dorsal fin is in advance of the anal, and its origin is not equidistant from the base of the pectoral and the end of the caudal fin. It arises in the posterior $\frac{1}{4}$ of the body.

The specimens from the hill-streams like Sikmai, Amambi, Phaidinga, etc., are slender, elongated and less deep, while those from the muddy streams are stouter and deeper. The muddy stream forms possess a soft dorsal fin like that of the genus *Adiposia*.[1]

The structure of the soft dorsal fin of *A. pangia* is very simple. The wall consists of a thin layer of epithelium and of a muscular layer internal to it. There are no specialized gland-cells and the muscular sheath consists of fine fibrils running transversely. The inner core consists of a highly vacuolated tissue, supplied with a few blood vessels which lie in the middle. The muscles do not run across the dorsal muscles but are continued along the body-wall.

[1] Annandale and Hora, *Rec. Ind. Mus.* XVIII,, pp. 183—186 (1920).

It is unfortunate that the collection of *A. pangia* in the Indian Museum is very poor. There is only one specimen No. 2590 from Mandalay and even that has been allowed to desiccate and is not fit for examination. I am, therefore, unable to decide whether the two species should be united until further collections from various parts of India are available for examination.

The largest specimen in our Manipur collection is 60 mm. in length. On dissection the females were found to contain eggs.

Acanthophthalmus pangia has a very wide range, extending over North Eastern Bengal, Manipur, Shan States, Burma to Java and Sumatra.

Nemachilus manipurensis, Chaudhuri.

1912. *Nemachilus manipurensis* Chaudhuri, *Rec. Ind. Mus.*, VIII, p. 443, pl. xl, figs. 4, 4*a*, 4*b*, and pl. xli, figs. 1, 1*a*, 1*b*.

Numerous specimens of this species were collected in the Auwlok and the Maklang rivers in the Kangjupkhul Hills; also a large number of specimens from Kangjupkhul *pukhri* (pond) behind the inspection bungalow.

Except for slight variation in the colour of some specimens, they argee with Chaudhuri's description of the species.

Nemachilus botia (Ham. Buch.).

1889. *Nemachilus botia*, Day, *op. cit.*, p. 227.
1919. *Nemachilus botia*, Annandale, *Rec. Ind. Mus.*, XVI, p. 127.

A single specimen 68 mm. in length was obtained at Ghaspani among the Naga Hills. The specimen is provided with a free orbital process below the eye and is probably a male. The lower lip is interrupted in the middle and is provided with characteristic cushion-like swellings.

Nemachilus botia is widely distributed all over northern and central India and also occurs in the Shan Plateau.

Nemachilus zonalternans (Blyth).

Plate X, figs. 3, 3*a*.

1860. *Cobitis zonalternans*, Blyth, *op. cit.*, p. 172.
1889. *Nemachilus zonalternans*, Day, *op. cit.*, p. 232.

This species is one of the commonest fish found in the Manipur Valley. Of 112 specimens, 77 are females and the rest males. The sexual dimorphism exhibited by this species is like that found in *N. botia* and consists in the males having a groove in front of the eye and a movable process of the preorbital bone.

N. zonalternans has hitherto been known from two specimens from Tenasserim. Both of these specimens are in the collection of the Indian Museum. One of these has been allowed to dessicate and the second one is not in a good condition for detailed examination. Moreover as the descriptions of Blyth and Day are meagre, I take this opportunity of writing a short note on the type-speci-

mens and a description of the species from fresh specimens, together with figures.

Having been long in spirit, the type-specimens have lost their natural colouration, except for certain markings on the caudal fin. There is also a faint black ocellus at the upper portion of the base of the caudal fin. The upper jaw is provided with a prominent knob in the middle. The lower lip is interrupted in the middle. The dorsal is considerably in advance of the ventrals. The lateral line is incomplete, ending below the origin of the dorsal. The eyes are nearer to the snout than the posterior extremity of the head.

Measurements of type-specimens in millimetres.

	A ♀	B ♀
Length of body (caudal excluded) ..	30·4	26·8
Length of head . ..	7·3	6·4
Diameter of eye	1·9	1·6

The following is a description of the fresh-specimens from Manipur:—

D. 3/9—10. A. 2/5. P. 11. V. 7.

The length of the caudal fin is contained $4\frac{4}{5}$—5 times, of the head $4\frac{4}{5}$—$5\frac{1}{4}$ times and the depth of the body $5\frac{1}{4}$—$6\frac{1}{3}$ times in the total length including the caudal fin. The diameter of the eye is contained 4—$4\frac{1}{3}$ times in the length of the head and $1\frac{2}{3}$ times in the length of the snout. *Barbels.*—There are six barbels, two rostral pairs and one pair maxillary. The maxillary barbels are slightly longer than the outer rostrals and are $1\frac{1}{2}$ times as long as the diameter of the eye. The inner rostrals are equal in length to the diameter of the eye. *Fins.*—The dorsal fin arises in advance of the ventrals and is almost as high as the depth of the body below it; its origin is nearer to the snout than to the base of the caudal fin. The caudal fin is slightly emarginate, with the upper lobe slightly the longer. The caudal peduncle is almost as high as long.

The mouth is small and semicircular and the mouth-opening reaches to just below the nostrils. The lips, the jaws, and the lateral line are as described in the type-specimens.

The colour of this loach has thus been described by Blyth and agrees with the Manipur specimens:—"It has a dark lateral streak, crossed by twelve short transverse bands, which alternate with about the same number of dorsal dark cross-bands. The dorsal fin is marked with three and the caudal with four rows of black spots; the other fins being spotless." There is, however, considerable variation even in specimens from the same locality. Some are uniformly pale and in some the dorsal surface is black and the belly white. There is always a black ocellus near the superior margin of the base of the caudal fin.

Nemachilus zonalternans is known from Tenasserim district (Burma) and is common all over the Manipur Valley.

Some female specimens on dissection were found to contain eggs.

Measurements in millimetres.

	♀	♀	♀	♂	♂	♂
Total length including caudal ..	40·0	40·0	40·7	36·3	40·8	35·7
Length of caudal . ..	7·6	8·2	8·1	7·2	8·9	7·3
Length of head	8·1	8·3	7·8	7·5	8·2	7·0
Depth of body	7·6	7·0	7·2	6·1	6·4	5·3
Diameter of eye	2·0	1·9	1·8	1·8	1·9	1·6

Nemachilus sikmaiensis, sp. nov.

Plate IX, fig. 4; plate X, figs. 1, 1*a*.

D. 2/8. A. 2/5. P. 11—12. V. 8.

In this fish the head is slightly depressed and the ventral profile is almost horizontal. The dorsal profile rises gradually from the end of the snout to the base of the dorsal fin, beyond which it slopes gradually to the base of the caudal fin. There are definite rows of open pores all over the head and those just above and below the eye meet posteriorly and are continued along the lateral line, which ends just above the middle of the anal fin.

The length of the head is contained 5—5$\frac{1}{5}$ times, of the caudal fin 5—5$\frac{2}{3}$ times and the depth of the body 7—8 times in the total length. The eyes are minute and are situated in the middle of the head. They look upwards and outwards and are invisible from below. The diameter of the eye is contained 4$\frac{1}{2}$ times in the length of the head. There are two pairs of nostrils, one on either side Their position is nearer to the eye than to the end of the snout. A fold of skin, provided with a sharp, barbel-like process, separates the nostrils of each side. It has an inferior, semicircular mouth, which is surrounded by thick lips. The lower lip is slightly notched in the middle and is devoid of any swellings or papillae. *Barbels.*—There are six barbels, two rostral pairs and one pair maxillary. The outer rostrals are the longest and extend to the posterior margin of the nostrils. *Fins.*—The dorsal fin is slightly in advance of the ventrals and is as high as the depth of the body below it ; its origin is equidistant from the nostrils and the base of the caudal fin. The pectorals are rounded and are shorter than the head and are separated from the ventrals by three-fourths of their own length. The ventrals are well developed and are provided with scaly appendages to their bases. The ventrals reach the vent. The caudal fin is deeply forked ; the lower lobe is slightly the longer.

The colouration of this species is very characteristic. There are 12—13 black rings round the body, separated by an equal number of slightly narrow white ones. In front of the ventrals the rings are incomplete and the under surface of the head and body is dull white. There is a black bar across the base of the

caudal fin and a black spot at the base of the first few dorsal rays. The rays of the dorsal fin have black markings along their length in the middle. The caudal fin is dusky and the rest spotless. In some examples the rings in the anterior portion are hardly distinguishable and the colour has become uniformly black.

The males of this species are provided with a thick, triangular pad below the antero-inferior margin of the eye.

Nemachilus sikmaiensis is distinguished from the rest by the simplicity of its lips, by the nature of the caudal fin which is deepy forked, by the fact that the lateral line does not extend beyond the middle of the anal fin and that the dorsal fin possesses only eight branched rays.

Type-specimens.—F 9932/1. *Zoological Survey of India* (*Ind. Mus.*).

Only nine specimens of this species were obtained in the Sikmai stream near Palel on the Burma Road.

Measurements in millimetres.

	♂	♀	♀	♀	♀
Total length including caudal	41·3	43·3	31·4	33·0	32·5
Length of caudal ..	7·2	8·1	6·3	6·3	6·2
Length of head ..	8·2	8·3	6·4	6·4	6·3
Depth of body ..	5·8	6·2	4·2	4·2	4·1

Nemachilus kangjupkhulensis, sp. nov.

Plate X, figs. 4, 4*a*.

D. 2/6—7. A. 2/5. V. 6—7. P. 9.

In this species the dorsal profile is slightly arched and the ventral is horizontal throughout. The head is bluntly pointed and slightly depressed. The under surface of the head and body is flat. There are open pores scattered all over the head, and a row of these just below the eye is continued along the lateral line. It has a ventral mouth, which is situated only a short distance behind the anterior end of the snout and is surrounded by thick lips. The upper lip is slightly notched and the lower widely interrupted in the middle. Behind the lower lip there is a cushion-like muscular pad, resembling the central callous portion of the disc of *Garra*. The lower lip is slightly fimbriated.

The length of the head is contained $5\frac{1}{5}$—$5\frac{3}{5}$ times, of the caudal 6—$6\frac{1}{2}$ times and the depth of the body 6—$8\frac{1}{3}$ times in the total length including the caudal fin.

The eyes are dorso-lateral in position and their diameter is contained $5\frac{1}{2}$ times in the length of the head. The snout is twice as long as the diameter of the eye. The caudal peduncle is $1\frac{1}{5}$ times as long as high. *Lateral line.*—The lateral line is incomplete and ends before the commencement of the dorsal fin. In some examples it extends to just above the end of the pectoral

fins. *Nostrils.*—There is a pair of nostrils on each side and their position is nearer to the eye than to the tip of the snout. *Fins.*—The dorsal commences almost opposite the ventrals; its origin is equidistant from the anterior margin of the orbit and the base of the caudal fin. It is almost as high as the depth of the body below it. The pectorals are shorter than the head and are separated from the ventrals by their own length. The ventrals do not reach the vent, which is situated on a raised papilla and is provided with thick lips. The caudal fin is slightly emarginate and in some examples the lower lobe is longer than the upper. The bases of the ventrals are provided with fleshy pendants.

There are seven to eleven broad black bands on the body separated by an equal number of white ones which are only half as broad. There is a black bar at the base of the caudal fin and a black spot at the base of first three rays of the dorsal. In some examples the bands in the anterior region get mixed up and the surface becomes uniformly dusky. The under surface of the head and body is white. Usually there are two black streaks radiating from the eye to the snout.

I have not been able to discover any outward signs of sexual dimorphism in this species. Some specimens on dissection were found to contain eggs. The eggs in this species are fairly big. In a specimen 43 mm. long, the diameter of an egg is 1·8 mm.

Nemachilus kangjupkhulensis is widely distributed in the hill-streams of the Manipur Valley.

Nemachilus prashadi, sp. nov.

Plate X, figs. 2, 2*a*.

D. 4/8. V. 8. A. 6. P. 11.

The length of the head is contained 5—5½ times, of the caudal fin 4⅘—5 times and the depth of the body 5—7 times in the total length including the caudal fin. In ripe females the greatest depth of the body is contained 5 times in the total length. *Eyes.*—The eyes are invisible from below and their diameter is contained 3⅘—5 times in the length of the head. *Barbels.*—There are six fairly long barbels, the inner rostrals extend to the nasal opening and the outer reach the beginning of the second third of orbit. The maxillary barbels are as long as the outer rostrals and are twice as long as the diameter of the eye. *Lateral line.*—The lateral line is well-marked anteriorly, gradually it fades away and ultimately disappears behind the anal fin. *Fins.*—The dorsal fin is in advance of the ventrals and its origin is nearer to the snout than to the base of the caudal fin. The pectorals are longer than the head and when adpressed almost reach the base of the ventrals which are provided with a short fleshy pendant. The caudal fin is deeply forked and in some female examples the upper lobe is slightly the longer. The caudal peduncle is 1¼ times as long as high. In mature females the pectorals do not reach the ventrals.

The open pores, noticed in the preceding species, are present all over the head and are continued along the lateral line as well. There is a well-marked prominence in the middle of the upper jaw and the lower lip is interrupted in the middle.

The lateral line is crossed by 13 short, black vertical bands. Above the lateral line the body is marked by a characteristic reticulum formed by numerous dark bands and blotches. The under surface of the head and body is pale olivaceous. There is a deep black bar at the base of the caudal fin and two dotted bands across it. The dorsal fin is marked by two bands and a black spot at the base of the first few rays. The remaining fins are spotless or in some examples very indistinctly marked.

The specimens of *Nemachilus prashadi* were obtained in Thonagpal tank and in Thoubal and Sikmai streams. Of 74 specimens, 40 are males and the rest females.

I have great pleasure in associating this fish with the name of my friend Dr. Baini Prashad, Assistant Superintendent, Zoological Survey of India, who has given me every possible encouragement in my work in the Museum.

Type-specimen.—F 9987/1. *Zoological Survey of India* (*Ind. Mus.*).

Order ACANTHOPTERIGII.

Family PERCIDAE.

Ambassis ranga (Ham. Buch.).

1889. *Ambassis ranga*, Vinciguerra, *op. cit.*, p. 163.

The individuals of this species from different localities show considerable variation in colour. Those from the Loktak Lake are dirty yellowish-orange, shot with minute black dots all over. These dots are aggregated to form 6—11 transverse bands on the body. A similar arrangement of dots forms a black blotch over the shoulder. The upper portion of the iris and the head are stained with black. In the young individuals the transverse bands are absent. The specimens collected in streams are lighter in colour and do not show any black dots, though in some cases the transverse bands are well marked.

Family NANDIDAE.

Badis badis (Ham. Buch.).

1889. *Badis buchanani*, Vinciguerra, *op. cit.*, p. 166.

There are altogether three specimens of the species, two of which were captured in Dhanashori stream and one in a small pool in thick jungle near Dimapur, Assam. In colouration the fish agree with Day's description of the Assamese specimens.

This species is said to occur all over India and Burma, but I did not get a single specimen of it in Manipur.

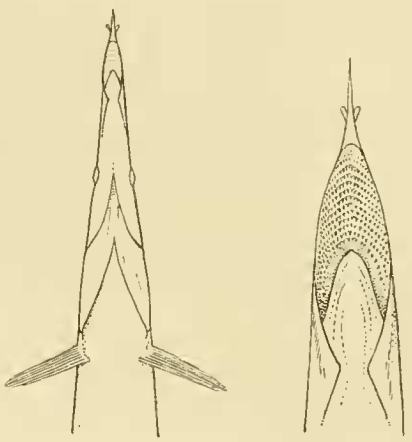
Family MASTACEMBELIDAE.

Rhynchobdella dhanashorii, sp. nov.

Plate IX, fig. 2.

D. 19/45. A. 3/47. C. 16. P. 17.

The length of the head is contained 7 times, of the caudal 14 times and the depth of the body 9⅓ times in the total length including the caudal fin. The diameter of the eye is contained about 5 times in the length of the head. The vent is situated nearer to the base of the caudal fin than to the tip of the snout. The mouth is small and does not extend to below the nostrils. There are no preorbital or preopercular spines. The fleshy appendage of the snout is broad and concave with transverse striations on the under surface. *Fins.*—The first dorsal consists of nineteen spines, which increase in length posteriorly except for the last one which is shorter than the rest. It commences at the beginning of the second third of the distance between the anterior end of the orbit and the base of the caudal fin. There are three anal spines close together, the middle one is the longest. The caudal fin is free both from the dorsal and the anal fins.



Text-fig. 5.—Under surface of head and snout of *Rhynchobdella dhanashorii*, sp. nov.

This species has a well-marked colouration. In spirit it is dull olivaceous speckled with numerous very characteristic pale lines extending downwards and forwards from the base of the dorsal fin and becoming obscure in the belly region. Behind the vent these lines are joined together in an irregular manner to form a reticulation. A pale longitudinal band extends backwards from behind the eye and becomes obscure in the post anal region. The lower surface is pale, speckled with black on the lower surface of the head. The fins are dark, minutely banded or speckled with dull white.

The only other known Indian species of the genus is *Rhynchobdella aculeata* which is said to occur in brackish waters within tidal influence and also throughout the deltas of large Indian and Burmese rivers. The new species differs from it in having a characteristic colouration and different proportions and also in the fact that *R. dhanashorii* occurs far inland in freshwater.

Type-specimen.—F 9989/1. *Zoological Survey of India* (*Ind. Mus.*).

A single specimen of this species was obtained in Dhanashori stream, about a mile from Dimapur, Assam.

Measurements in millimetres.

Total length including caudal	98·0
Length of caudal fin	7·0
Depth of body	10·5
Length of head	14·0
Diameter of eye	3·0

Mastacembelus manipurensis, sp. nov.

Plate IX, fig. 3.

The proportions show considerable variation with the age of the fish. In a specimen about 23 cm. long, the depth of the body is contained 9 times in the total length and the length of the head about 6 times. In an older specimen 44 cm. in length, the depth of the body is contained 13 times and the length of the head 7 times in the total length. The diameter of the eye is contained 7—11½ times in the length of the head. The vent is situated much nearer to the base of the caudal fin than to the end of the snout; its position can thus be located in the older specimen :—

Distance of vent from end of snout	..	22·7 cm.
,, ,, ,, base of caudal fin	..	19·6 ,,
,, ,, ,, end of caudal fin	..	21·0 ,,

The preorbital spines are absent, but there are three well-marked preopercular spines which increase in length from below upwards. The fleshy appendage to the snout is short and is 7 mm. in length in the older specimen. *Fins.*—The caudal fin is completely united with the dorsal and the anal fins. The spiny portion of the dorsal consists of 37 spines and commences above the middle of the pectoral. The rayed portion of the dorsal is leathery and low, so it is rather difficult to count the number of rays with exactness. There are, however, 66—72 soft rays. The anal fin has three spines close together, the middle one is the longest and the stoutest. The anal spines can only be made out after a careful dissection. There are about 50 rays in the anal fin.

In the older specimen, the dorsal surface of the head and body and the whole of the tail portion is black, with about 23 short black bands across the dorsal surface. The colour of the body below the lateral line and on the under surface of the head is pale olivaceous, gradually fading into yellow on the ventral surface. There are four irregular dark longitudinal bands on either side of the body, commencing from near the head and becoming indistinguishable in the region behind the vent. There is a characteristic dark band along the midventral line extending from the

head to the vent. On the sides and the under surface of the head there are short irregular bands forming a reticulum. There is a short band between the eye and the base of the pectoral fin. The pectoral is marked with a few dotted bands.

The following short description may be given to facilitate the identification of the species according to the synopsis of the species of the genus given by Boulenger [1] :—

Snout scaly on the sides ; three anal spines ; caudal completely united with dorsal and anal ; vent considerably nearer caudal than end of snout ; preorbital spines absent ; 3 preopercular spines present ; dorsal fin with 37 spines ; mouth extending to below nostrils in adults while it does not extend so far in the younger specimen.

By these characters the new species approaches *M. erythrotaenia*, Blkr. and *M. caudatus*, McClell. From the former it differs in having 3 instead of 4 preopercular spines and in having fewer rays to the soft dorsal and the anal fins and also in colouration and proportions ; from the latter in the fact that the mouth does not extend to below the anterior third of the eye and the number of rays both in the dorsal and the anal fins is not so great.

Since his synopsis, Boulenger has described three new species of the genus *Mastacembelus*, viz. *M. moeruensis*,[2] *M. stappersii* and *M. mellandi*.[3] I have consulted the descriptions and do not find any close affinity with the new species

Type-specimen.—F 9990/1. *Zoological Survey of India* (*Ind. Mus.*).

Only two specimens of this species were obtained in Khurda stream, near Thanga Id.

Measurements in millimetres.

	A.	B.
Total length including caudal ..	440	129
Depth of body	35	14
Length of head excluding fleshy snout ..	64	21
Diameter of eye	5·5	3
Length of snout excluding fleshy portion ..	18·5	7·2
Length of caudal	21	4
Length of pectoral	19	6·7

Family OPHIOCEPHALIDAE.

Ophiocephalus punctatus, Bloch.

1889. *Ophiocephalus punctatus*, Vinciguerra, *op. cit.*, p. 186.

Only one specimen of this species was obtained in a dirty pool in thick jungle near Dimapur, Assam.

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[1] Boulenger, *Journ. Acad. Nat. Sci. Philadelphia* (2) XV, pp. 197—203 (1912).

[2] Boulenger, *Rev. Zool. Africaine*, III, p. 440 (1913—14).

[3] Boulenger, *Ann. Mag. Nat. Hist.* (8) XIV, p. 386 (1914).

In *O. punctatus* the subopercular bones overlap or come very close to each other on the under surface of the head. The body is sharply marked into two regions, the upper surface of the head and the body is dark, while the belly and the lower surface of the head are white. There is a dark band along the side of the head from the snout to the angle of the operculum. There are also a number of alternating bands above and below the lateral line. The belly and the under surface of the head are speckled with black dots. There is a white transverse bar at the base of the caudal fin and all the fins have dotted bands.

Ophiocephalus harcourt-butleri, Annandale.

1918. *Ophiocephalus harcourt-butleri*, Annandale, *op. cit.*, p. 54, text-fig. 2; pl. ii, fig. 7; pl. iv, figs. 16, 17.

Specimens from the Shan States show great variation as regards the number of fin-rays both in the dorsal and the anal fins. Dr. Annandale gives the formula as:—D. 28—38. A. 16—25. The specimens of this species from Manipur are, however, constant as regards this character. Of a large number of specimens in which I counted the rays, only in one case was the number of rays in the dorsal fin found to be 35, while 34 is the rule. The anal fin always had 23 rays. Both types of colour-forms occur in our collection and the young individuals are characterized by a black ocellus at the base of the pectoral fin, followed by a number of black lines. In almost all cases the vertical and the caudal fins have a narrow reddish-orange band along their edge.

Ophiocephalus harcourt-butleri is widely distributed in the Southern Shan States (Burma) and the Manipur Valley. In the Manipur Valley it is common in the Loktak Lake and in the marshes surrounding it.

FISHERIES OF THE MANIPUR VALLEY AND OF THE NAGA HILLS OF THE SOUTHERN WATERSHED.

Owing to their religious tenets the Manipuris are forbidden any kind of animal food except fish, which thus forms a very important item in their diet. In the Loktak Lake, where traps and other fishing appliances are used in great variety, the state does not levy any kind of tax, consequently near Thanga Island, which may be described as the headquarters of the fishermen, fishing is carried on throughout the year and at all hours of the day and night, and every Manipuri irrespective of age and sex is engaged in fishing. Even in other places it is a common sight to see young boys and girls catching small fish from ponds with baskets. *Lai*[1] Manipuris do not spare even the molluscs and *Acrostoma variabile*, the soft parts of which are sucked out after boiling, is highly esteemed.

[1] *Lai*=Villagers. The Manipuris of the big towns look upon villagers as of low caste and usually do not mix with them.

From the fisheries in other areas, the state realises a good income. The total is estimated to be between Rs. 60,000 and 1,00,000 annually. The main rivers of the valley are divided into stretches, each about a couple of miles in length. The fishery rights in each of these areas are publicly auctioned every year and each fishery fetches from Rs. 400 to 500. The money is paid to the state in instalments; but usually, as I gathered from a talk with Mr. A. C. Eleazar, the full amount is never realised. The Waithu-pat, a lake some ten miles from Imphal and lying on either side of the Burma Road, is the most important centre, not only because it brings an income of Rs. 8,000 to 10,000 a year, but because the entire supply for the Imphal market of the big edible fish (*Wallago attu*) comes from this place.

Fishing Boats.

The only type of boat used in the Loktak Lake is a dug-out. It generally consists of a single piece of wood with a flat bottom, hollowed out to form a boat. The anterior end is broad and somewhat squarish. The boat is rowed with a single paddle having a long blade. A small boat costs from Rs. 15 to 18. Near Thanga Island some big boats are also used for fishing and as a means of transportation. In the Imphal River, the tradesmen also use big boats which are not dug-out but real flat-bottomed boats of similar shape.

Manipuris are very fond of boat-racing. During the rainy season, a racing competition is held every year in the Imphal River. On this occasion two big boats are used with dragons carved on their sides.

Fish-traps.

A series of characteristic traps are used in running water for capturing large quantities of fish. A trap consists of three parts, each performing a definite function. The first part consists of a superficial dam, built of bamboo poles and dry grass and extends almost across the stream, leaving only a passage for boats. The function of this dam is to prevent floating weeds and other debris from choking the traps which are laid further on. About twenty yards below this dam, another stronger dam is built of the same material, but here the grass is held together by sticky mud. It does not come quite up to the surface, and the water either flows over it or through the boat passage. To the upper edge of the poles, just at the level of the water, numerous traps are fixed close together. Each trap consists of two parts. The *chora-ruh* or the upper part has the form of a conical tube and is attached by its wider end to one of the poles. The second portion or *lusak* is also conical but is closed at the narrow end. It telescopes a little over the end of the first part and is attached to it by means of a string. The *lusak* thus acts as a sort of a purse for all the fish that enter the trap and is detached from time to time and emptied of its contents.

By this elaborate arrangement all the fish crossing the dam near the surface are trapped.

The third dam is built about twenty yards still further down and is designed for the capture of bottom-fish which pass the second dam through the boat channel. It is only about a foot or so high from the bottom of the stream and is built across the whole of its breadth. Above the surface of the water the only traces of this dam are three pairs of strong bamboo poles firmly fixed in the ground; a pair is placed in the centre of the stream and one on each side of it near the bank. To the dam itself a series of spindle-shaped traps is attached. The *Kalio-ruh* is a spindle-shaped trap pointed anteriorly, and having an opening at the posterior broader end; this opening is plugged when the trap is laid. The entrance into the trap is on the under surface and consists of a conical tube made of bamboo splints; at the inner end these splints are sharply pointed so that a fish once it has passed into the trap is unable to get out again. The arrangement for keeping the trap in position is illustrated on plate xii, fig. 7. For this purpose strong bamboo pegs (*auúng*) about 46 cm. in length are employed. Each is made by doubling a length of bamboo on itself and thus possesses a loop at its upper end. One peg is thrust into the dam on each side of the trap and the two are lashed together by grass which is passed through the loops. Each trap is also secured by a length of bamboo with pointed ends which is bent over the trap and driven into the ground on either side. The double peg thus formed by the length of bamboo is called *chikap*. Under the *chikap* and all around it tufts of grass are woven in order to give the whole arrangement the appearance of an impassable barrier.

After every four or five hours the traps are taken out and emptied of their contents which frequently consist of a very large number of fish. The method of taking out the trap is rather peculiar. A long bamboo pole is thrown across the stream and is held in position by two of the three pairs of bamboo poles already mentioned. A rope is now tied to a boat and is passed along the horizontal bamboo pole. A man dives, releases the *chikap* on one side and brings out in turn the *kalio-ruh* in this region and passes them on to another man in the boat, who empties them of their contents by removing the plug at the broader end of each. When all the fish are jerked out the plug is replaced and the trap again set in position. This is a very successful and elaborate method and maunds of fish are daily trapped in this way.

The *kao* (pl. xii, fig. 1) is another kind of trap used in shallow streams. It is stuffed with grass and dry sticks and tied to a bamboo peg driven into the bank. Fish seeking shelter get amongst the grass and sticks and remain there. The trap is allowed to remain in the water for two to three days and is then rapidly dragged out. The fish are unable to free themselves quickly and are thus easily secured.

A *kao* which was seen in use in the Wang-jing stream near the village of the same name was 2 ft. 2 in. in height, 5 ft. in length and 6 ft. broad.

The fish generally caught in this trap are *Crossochilus latia* and *Botia berdmorei*, besides smaller species such as *Barbus ticto* and *Lepidocephalichthys irrorata.*

The *tikhau-ruh* or "trap of the Assamese" is the biggest trap used in the streams of the valley. It is circular, pointed at one end and with a funnel-shaped passage of bamboo spikes converging inwards at the other end. A strong bamboo pole is lashed to one of its sides for the attachment of ropes. Two ropes are used, one is tied to the closed narrow end of the trap and the other to the pole. A *tikhau-ruh* seen in the Imphal River was 7·5 ft. in length and 2½ ft. in diameter. The funnel was 2¼ ft. in length and the bamboo pole 3½ ft. The length of the ropes varies according to the stream in which the trap is used (pl. xii, fig. 4).

The method of using the trap is interesting and throws some light on the breeding season of Manipur fish. The open end is placed down stream during the months of February and March, whilst during September and October the same end is placed pointing up stream. According to the Manipur belief, the fish ascend the streams during February and March and descend during September and October. In using the trap, a long bamboo pole is fixed vertically in the middle of the stream. A rope from the narrow end of the trap is tied to the pole, while the broader end is attached by a second rope to a peg on the bank.

Many other varieties of traps are used in the Loktak Lake. These, however, do not differ from those commonly used in Bengal and which have been described by Anderson.[1]

Other characteristic traps are used by the Nagas and Manipuris for catching small hill-stream fishes. The *lo-lu* (pl. xii, fig. 3) of the Nagas is a funnel-shaped trap, with the narrow part greatly elongated and slightly dilated at the end. The bamboo sticks, of which it is made, have a spiral twist and are held in position by cane strings which run spirally from one end to the other. It is used in places where there is an abrupt fall in the water level. In such places the trap is fixed by means of a cane string and a peg, with its broad end pointing up stream. The narrow end is plugged with grass and small fish travelling with the current are carried into the trap. Owing partly to the rapidity of the flow of water and partly to the fact that they are confined in the narrow neck of the trap, they are unable to escape.

The Manipuri *lo-lu* (pl. xii, fig. 2) is similar but shorter and more massive. Instead of a single cane string it has two which are tied to two pegs one on either side of the small channel of water in which it is used. The Manipuris often use this kind of trap in their rice-fields, where the water from a field at a higher level flows to another at a lower level.

[1] Anderson, *Cat. Fish. Appliances, Bengal.* (1883).

Basket Appliances.

Only two kinds of baskets are used for catching fish in the valley and one is of a type only to be found in the country bordering on the Loktak Lake.

The *lóng* (pl. xi, fig. 6), which is widely used all over the valley is bowl-shaped and is made of coarsely woven bamboo strips. The circular brim of the basket is formed of strong bamboo tied to the lower net-like portion by cane strings. A man using the basket dips it into the water and then disturbs the grass in front of it with his feet. The fish are thus driven in the basket which is, then, suddenly taken from the water and the catch transferred to an earthen pot which is carried tied to the waist. One of the baskets was measured to be 47 cm. in diameter and 31 cm. in height.

The second type of basket, the *chigai-lóng* (pl. xi. fig. 5) is saucer-shaped and is generally provided with a bamboo handle, the *machai*. The basket is shoved underneath a floating island and the grass is disturbed from above. It is then quickly withdrawn and small fish and insects are taken from it. It is chiefly used for collecting insects for baiting purposes. One I examined was 85 cm. in its longest diameter, 12 cm. in depth and the length of the handle was 200 cm.

I may here refer to a peculiar type of basket which is used for scooping out water. In marshy places the thick grass is cut with a long sickle and removed. The water is then scooped out with the basket, the *ishto-machai* (pl. xi, fig. 3) and the wriggling fish are caught with the bare hands. This method is employed for capturing *Ophiocephalus harcourt-butleri* and *Clarias batrachus*. The measurements of one seen at Thanga Island were: length of the handle 140 cm., the length of the basket 95 cm. and the depth of the basket 17 cm.

Nets.

Besides the cast net and the big seine net, the well-known *maha-jal* of India, there are three peculiar types of nets which may be briefly described.

The *lungtharai machai* (pl. xi, fig. 4) is like the shallow basket-net, *chigailong-machai*. It is extensively used among *Hydrilla* plants on the Potsengbaum side of the Loktak Lake. A long bamboo pole is used for disturbing the weeds and for throwing them off the net. The net without the handle or *machai* is also used like the *lóng* in various marshy places in the valley.

The most characteristic net is the *ilb-hungen-paura* of the Manipuris. It consists of a rectangular net 7 to 8 ft. long and 3 to 4 ft. wide. The net is spread out by two bamboo arches placed diagonally across it, each arch consisting of two pieces tied together in the middle. Where they cross, the arches are lashed together by a cane string in such a way that they can be folded together when the net is separated from them. A long bamboo pole is tied to the junction of the arches. In the Loktak Lake

the net is used by women from a boat. The bamboo pole is held between the thighs and is alternately raised and lowered by a peculiar movement of the right leg and both hands. In each boat there are two women, one of whom manipulates the net while the other rows the boat and drives the fish into the net by beating the boat with a short bamboo stick. The peculiar noise thus produced is to be heard day and night at Thanga Island.

The arrangement and the method of using the net is different in other parts of the valley. A rope is tied to the bamboo pole near the junction of the two arches and the pole is loosely fixed in the ground to serve as a fulcrum. The net is lowered or raised by means of the rope. With this arrangement the net is called *ilb-jung-thauri* (pl. xi, fig. 1.).

A kind of gill-net is also used in the Loktak Lake. Large pieces of pith tied along the upper edge act as a float, while the lead-weights attached to the lower edge keep the net vertical. The net is shot in a suitable place; the boats manoeuvre in the vicinity, herding the fish into the net, in which they are meshed.

All kinds of nets used in the valley are provided with a small mesh only a few millimetres in width.

Fishing Enclosure.

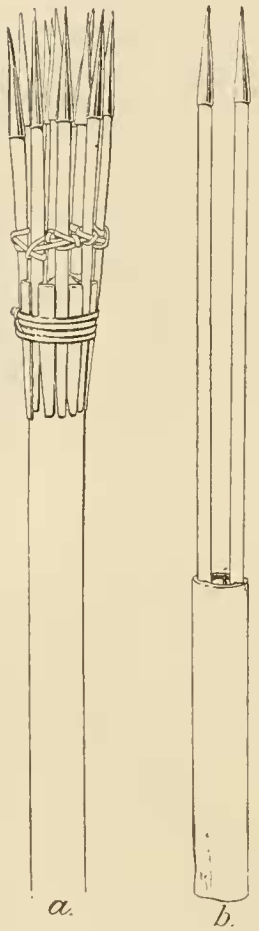
Big fishing enclosures are constructed in the Loktak Lake and sometimes large quantities of fish are captured in this way. A fairly big piece of a floating island is cut and drifted away to a suitable place and is fixed in position by passing long bamboo poles through it into the bottom of the lake. The island thus fixed is allowed to remain in one position for several days. After some time an enclosure of bamboo poles and grass is built around it, a little higher than the level of the water to prevent fish from jumping out. On the completion of the enclosure the floating island is cut into small pieces and cleared, but all the small fish which may be present in the grass are carefully collected. After the surface is cleared of floating material, the water is made muddy by making buffaloes move in it in all directions. Different kinds of nets are used for taking the fish out, the most efficient being the *ilb-hungén-paura*.

Near Thanga Island it is a common sight to see young boys and girls paddling a small piece of floating island to their homes by placing their small boat across it. Near their home the island is fixed in position by long bamboo poles and serves to attract fish by reason of the shelter it provides.

Fish Spearing.

The spears used in the valley are of two kinds, one with two prongs, the other with several (as many as eleven or more). The former is used in spearing *ngapuram* (*Monopterus albus*), and is known as the Naga *laou*. It consists of two long bamboo sticks bearing iron prongs at one end and tightly fixed by wedges at

the other end inside the hollow of a thicker bamboo which forms the handle. The handle of the spear is about 8 inches in length while the total length is five feet. The Manipuri *laou* is constructed on an entirely different plan. It consists of a fairly long and thick bamboo pole, at one end of which several short sticks with iron prongs at their ends are firmly fixed. Some of these are fixed inside the hollow of the pole, just as in the Naga *laou*, but others are tied all round it with a cane lashing. Bamboo splinters are wedged in between the prongs to keep them in position. This spear is chiefly used for catching big fish in the Loktak Lake. When a fisherman sees some disturbance in the grass, he throws his spear at the place. I was given to understand that as big nets cannot be used in the lake on account of the thick vegetation, all the large sized fish are captured with this spear.



Text-fig. 6.—Drawings of models of fish spears.
(*a*) Manipuri *laou* for spearing ordinary fish.
(*b*) Naga *laou* for spearing eels.

Hooks and Lines.

I did not see any fishing-rods in use in Manipur, but I was informed that a crude type of rod is used in the valley. Peculiar bamboo hooks, sometimes tied at intervals to a long line were seen in use in the Loktak Lake. The hooks consist of thin bamboo splinters sharpened at both ends and notched in the middle for the lashing. They are very flexible and the bait, which consists of worms and insects or of small species of *Barbus*, is put on by bringing the two ends together. The efficiency of the hook depends upon the elasticity of the bamboo, for as soon as the fish has swallowed the bait, the hook opens out; the ends penetrate the side of the mouth, often protruding through the gill openings. Several scores of these hooks are used in making a line.